Dual

Service Manual Dual TG 28

Edition 1 E TG 28

Adjustments

Service tips

High fidelity Stereo tape deck Dual TG 28

Lubricating instructions

Parts list

Dual Gebrüder Steidinger · 7742 St. Georgen/Schwarzwald

D 793 219 847 3/1069 Zö

dualcan

Printed in Germany

Fig. 1 Chassis

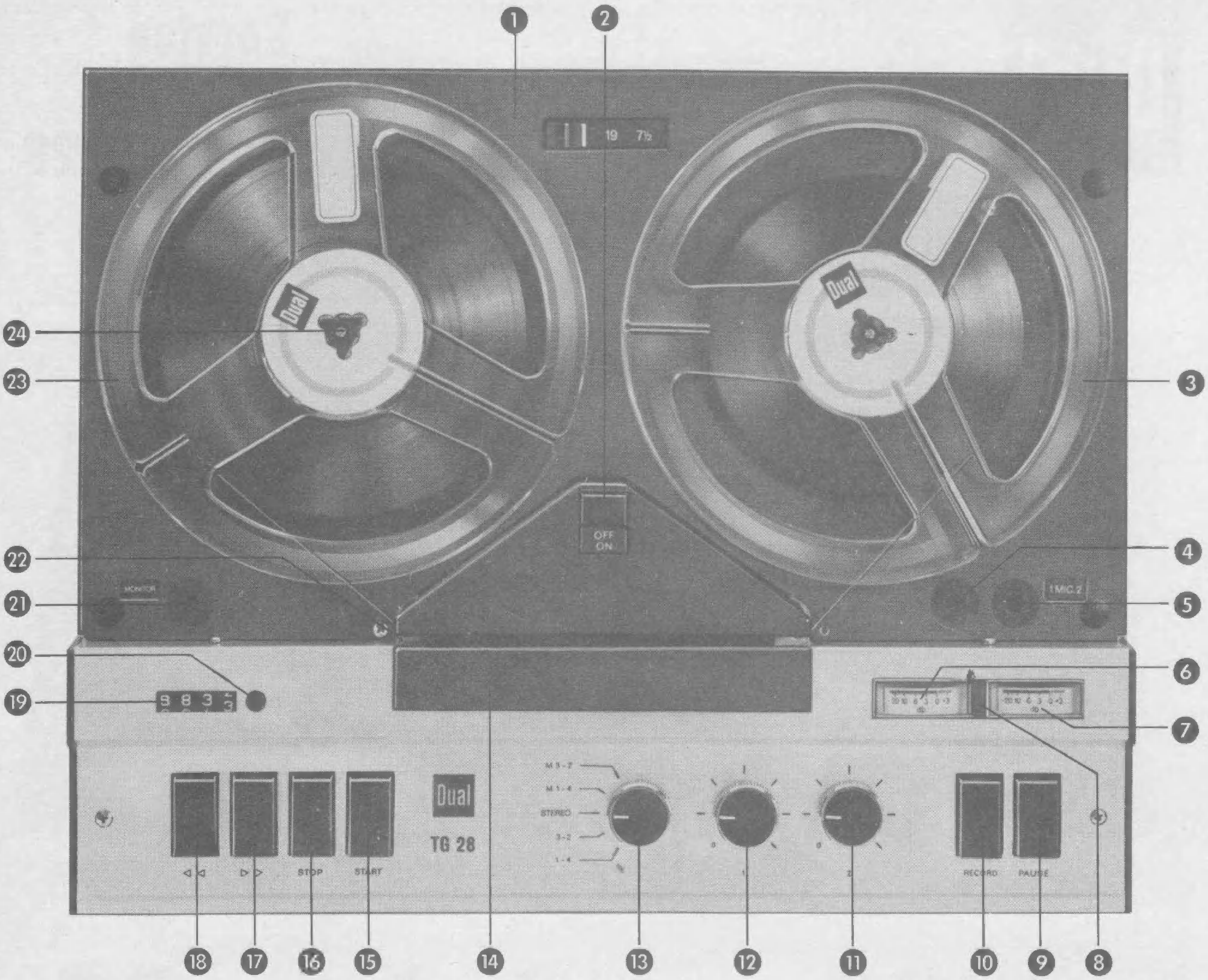
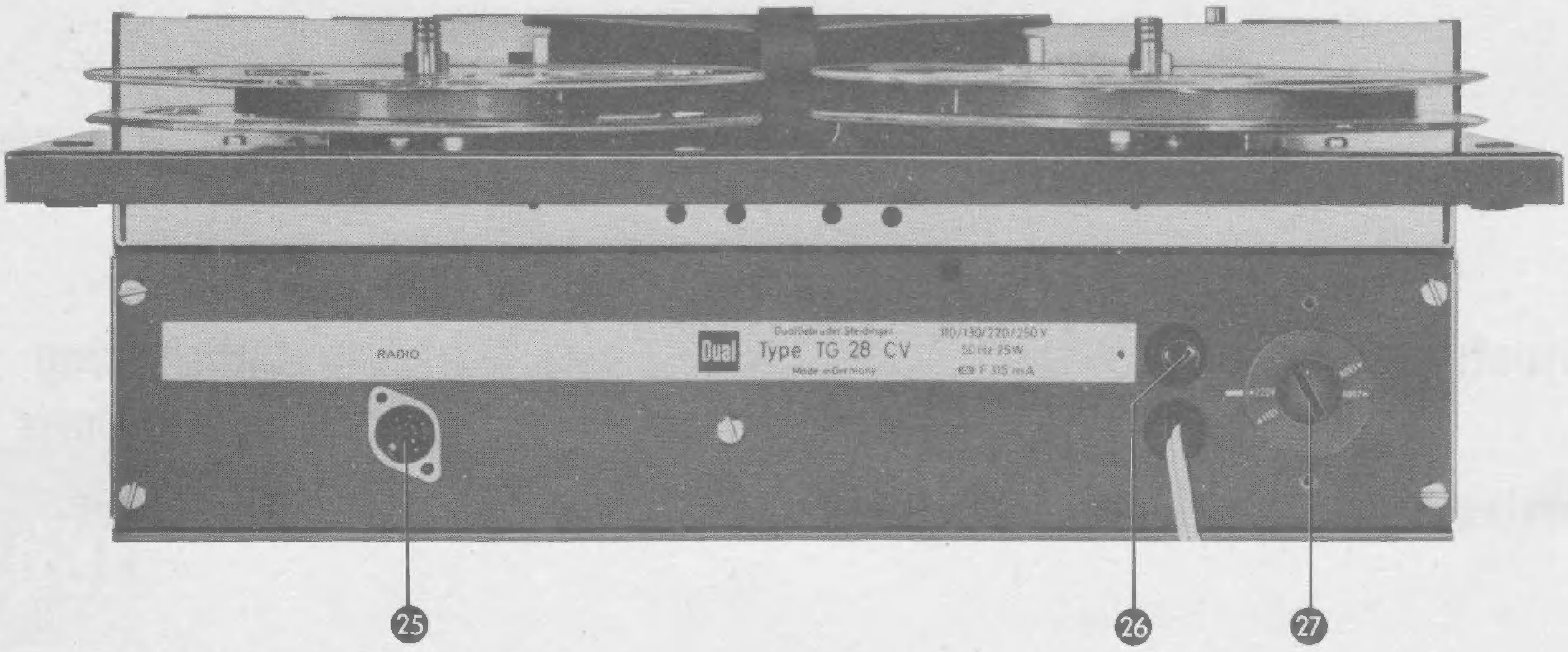


Fig. 2 Back view



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Operating features

① Speed selector

② On / off switch

③ Take-up reel

④ Microphone jack MIC-1

⑤ Microphone jack MIC-2

⑥ V.U. recording meter, channel A

⑦ V.U. recording meter, channel B

⑧ Recording light indicator

⑨ Fast stop key "PAUSE"

⑩ Recording key "RECORD"; hold stop key down when depressing "RECORD" key.

⑪ Record level control. Channel 2 controls right channel, or multiplay mixing; or, in case of mono mixing, the microphone 2, record player and second tape recorder unit.

⑫ Record level control, channel 1. If button is pulled up, it controls the left channel or, in case of mono mixing, microphone 1.

⑬ Channel and mode selector switch separately

⑭ Cover panel

⑮ Start key

⑯ Stop key

⑰ Fast forward key

⑱ Fast rewind key

⑲ Tape counter

⑳ Re-set button for tape counter

㉑ Headphone jack for stereo headphones with approximately 2 kOhm impedance

㉒ Tape slot

㉓ Feed reel

㉔ Reel spindle

㉕ Radio jack

㉖ Power line fuse

㉗ Voltage selector

Technical data

The unit meets the requirements of DIN (German Industry Standard) 45 500 on high fidelity standards at 7½ i.p.s. The unit has been measured with the DIN blank tape.

Line voltages:	110 / 130 / 220 / 250 volts 50 Hz, adjustable to 117 V 60 Hz
Power consumption:	approx. 25 watts
Fuses:	2 x G-fuses F 315 MA
Track placement:	4-track international
Heads:	1 combined record playback head with hyperbolic contour finish 1 double-gap ferrite erase head
Tape speed:	19.05 cm/sec (7½ i.p.s.) ± 1 % 9.53 cm/sec (3¾ i.p.s.) ± 1.5 %
Wow and flutter: DIN 45 507	Loudness/contour controlled at 7½ i.p.s. ± 0.10 % at 3¾ i.p.s. ± 0.15 %
Frequency response: DIN 45 511	at 7½ i.p.s. 35 – 18,000 Hz at 3¾ i.p.s. 35 – 13,000 Hz
Equalization: DIN 45 513	at 7½ i.p.s. 1590/50 µs at 3¾ i.p.s. 1590/90 µs
Distortion: DIN 45 511	K_3 = 5 % measured at 333 Hz full recording level K_{ges} = 1.5 % at 333 Hz and – 6 dB recording level
Signal-to-noise ratio: DIN 45 405 CCITT DIN 45 511	measured with low-noise tape at 7½ i.p.s. 54 dB at 3¾ i.p.s. 52 dB
Stray noise ratio: DIN 45 405 CCITT DIN 45 511	measured with low-noise tape 46 dB
Cross talk transmission equivalent: DIN 45 521	measured at 1 kHz stereo ≧ 50 dB mono ≧ 60 dB
Erasure damping: DIN 45 510	at 1 kHz measured ≧ 70 dB
Oscillator frequency:	95 kHz
Inputs: DIN 45 511	2 x microphone 0.15 mV (impedance 200 . . . 700 Ω) radio 0.15 mV phono 50 mV at Ri = 1 M Ω
Outputs: DIN 45 511	Output voltage at full level radio 0.775 V at Ri = 18 K Ω monitor 0.775 V at Ri = 4 K Ω
Semi-conductor transistors:	transistors: 2 x BC 149 C, 4 x BC 148 C, 1 x BC 107 B; 6 diodes
Pilot light:	12 V 1 W glass base W 1.8 d
Size of reel:	up to 7" diameter
Playing time for 7" reel:	at 3¾ i.p.s.; triple play tape, maximum 3 hours in one direction
Rewind time:	3½ minutes for 7" reel with 540 m tape
Dimensions and weight:	Dual CTG 28 dimensions: 420 x 363 x 190 mm; weight: 7.7 kg Dual TG 28 CV dimensions: 383 x 298.2 x 134.5 mm; weight: 6 kg

a) Mechanical section

1. **Dismounting and mounting**

   To dismount the CTG 28 first remove the grounding screw. The dress plate need not be removed for dismounting and mounting the unit. The unit is mounted on the mounting board by means of four screws; these four screws are located underneath the four plastic covers on the dress plate. Use a knife blade to lift off the plastic covers.

   The dress plate can be removed after removing the knobs and after the six Phillips screws on the dress plate and next to the keys have been removed.

2. **Cleaning**

   Whenever repair work is done, the unit should be cleaned. The recording head (83), erase head (64), tape guides (48, 88), and the capstan as well as all the rubber rolling surfaces, must be absolutely clean at all times.

   To clean these parts, use a linen cloth moistened with turpentine substitute. To clean the buttons, the cloth may be wound around a wooden stick. Do not use a screwdriver.

3. **Brakes**

   The brakes work on the principle of rope looping and they are controlled via the feeler lever, directly by the tape. This results in a constant tape pull. The force of the tape pull depends on the adjustment of the brakes. This pull is proper when the embossed line M at the brake levers is positioned under the marking notches of the head mounting plate. Adjust by turning the adjustment bolts (J).

   To measure the tape pull, place a 7" tape reel on the rewind spindle (20) concerned, fasten the tape leader to a spring balance scale, and pull the tape slowly, at approximately tape speed, straight ahead through the open tape slot. The tape pull has to be 30 – 35 grams. If the tape pull is too slight, it will lead to poor tapehead contact and thus to drop-outs in playback. If the tape pull is too strong, the tape movement will be faulty during the rapid forward and rewind.

   After a new brake cord has been installed (3, 271), the brake plate in the brake lever (24, 128) must be protected again by means of glyptol varnish primer. Prior to the final adjustment, the brake rope must be stretched forcefully once so that the rope cannot give way in its anchoring points.

4. **When the drive pulley is assembled,** care must be taken to follow the proper sequence of the individual parts according to Fig. 4. The contact surface between friction wheel (338) and spring (339) must be greased. The individual parts must be firmly screwed together with flat head screws (335).

5. **Speed selection**

   For speed change, move the drive belt (73) through the shift fork (11) (while the belt is running) from one drive pulley to the other. The drive belt (73) must, at both tape speeds, pass freely between shift fork (11) and guide rod (12). An adjustment is made by bending the metal tabs at the shift fork (11) or shift lever (10) respectively, and by axial displacement of the drive pulley (340). To displace drive pulley (340), loosen the set screw (341) which is located on the side.

Fig. 3

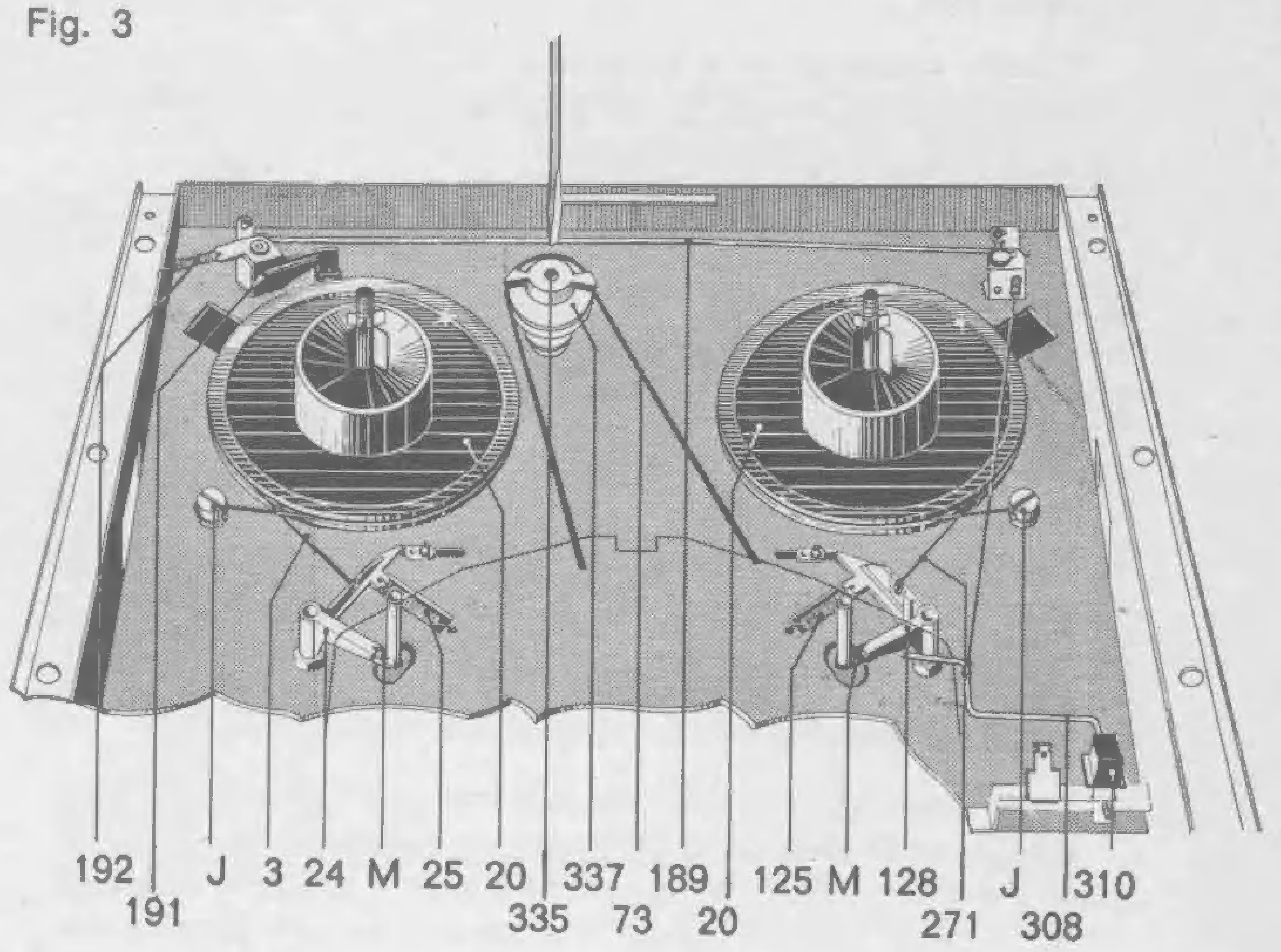


Fig. 4

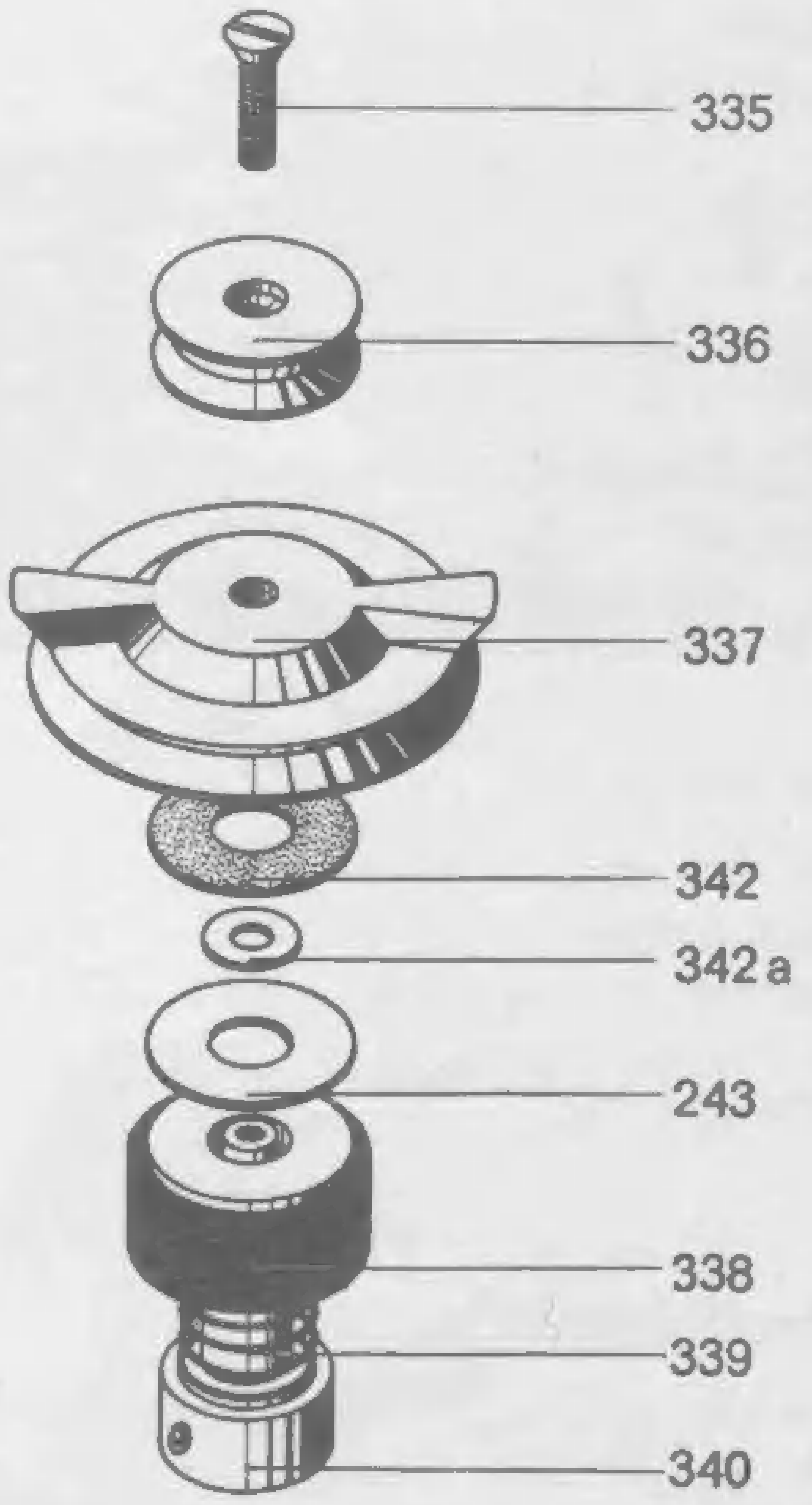
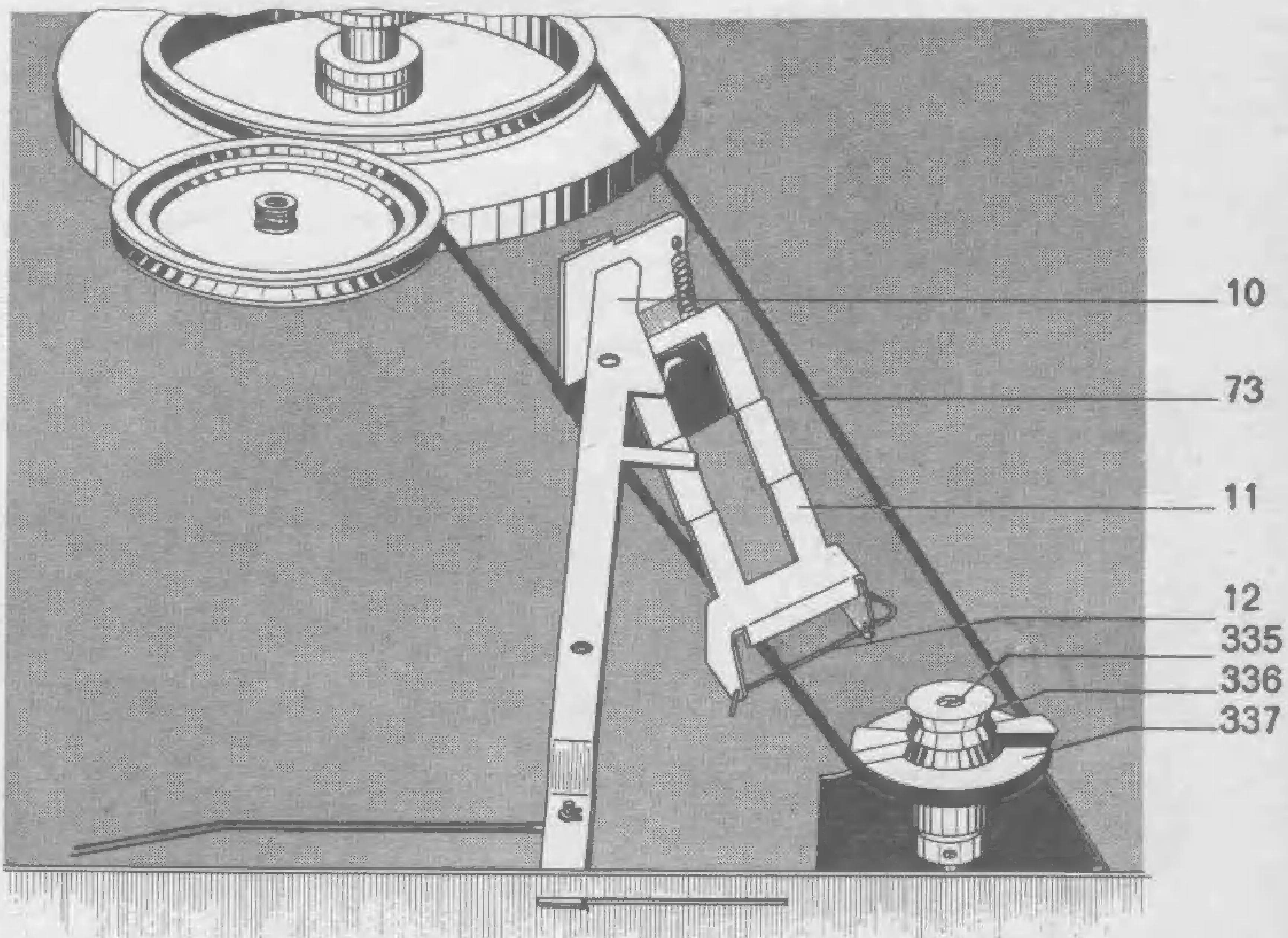


Fig. 5



6. **Drive belt**

Change stretched or defective belts (73). Remove from the motor pulley (336, 337) and, after bending up and releasing the guide rod (12), remove belt from the shift fork (11). Push out shift lever (11) and loosen belt (73) from the flywheel (101). Loosen the three mounting screws of the capstan bearing (91), and pull off capstan bearing (91) in upward direction. Through the resulting opening between capstan (101) and head mounting plate (93), the belt (73) can now, by means of a wire hook, be lifted over the capstan (101) and pulled out. Replacing a new belt is done in reverse order.

CAUTION: Under no circumstances must the drive belt become oily or greasy since this would ruin the belt.

7. **Recording interlock**

The recording interlock blocks the recording key (310) which can be depressed only when the stop key is depressed at the same time. The recording block is properly adjusted if the front side of the control wire (239) is flush with the face side of the recording plunger (287). For proper adjustment, move adjustment clamp (99).

8. **Fast stop**

The fast stop key "Pause" is for the interruption of the play. The fast stop is properly adjusted if the stop rod (308) during play is 0.5 – 1 mm from the pressure bracket (150). With the fast stop key depressed, the stop rod should engage approximately at the center of the pressure bracket. Proper adjustment is done by bending the stop rod.

The brake angle should, if not operating, be approximately 0.5 – 1 mm from the rubber ring of the rewind spindle (20). To adjust, bend brake angle (191).

9. **Main switch**

With the recording key depressed, the metal tabs of the switch angle (320) in front of the main switch on the amplifier printed circuit board (325) must be positioned so the contact springs of the main switches are flush with the contact blades.

10. **Output switches**

With the start key depressed, the metal tab of the pressure lever (155) that engages the output switch must be positioned so the contact springs of the output switch are flush with the contact blades.

11. **Motor**

When the motor (250) is changed, care must be taken that the connection cables do not impair the swinging motion of the motor during the fast forward and rewind. In order to avoid such impairment, the cable loops between motor and cable clamp or printed circuit plate respectively must be as large as possible and freely movable. The drive pulley (340) must be screwed on in such a manner that the belt (73) passes freely between shift fork (11) and guide rod (10) and that the speed selection functions properly.

12. **Adaptation to a different line frequency**

To adapt to another line frequency, change the drive pulley assembly (344) which can be pulled off after the set screw (341) has been removed.
Drive pulley 50 Hz No. 214 595
Drive pulley 60 Hz No. 214 596

Fig. 6

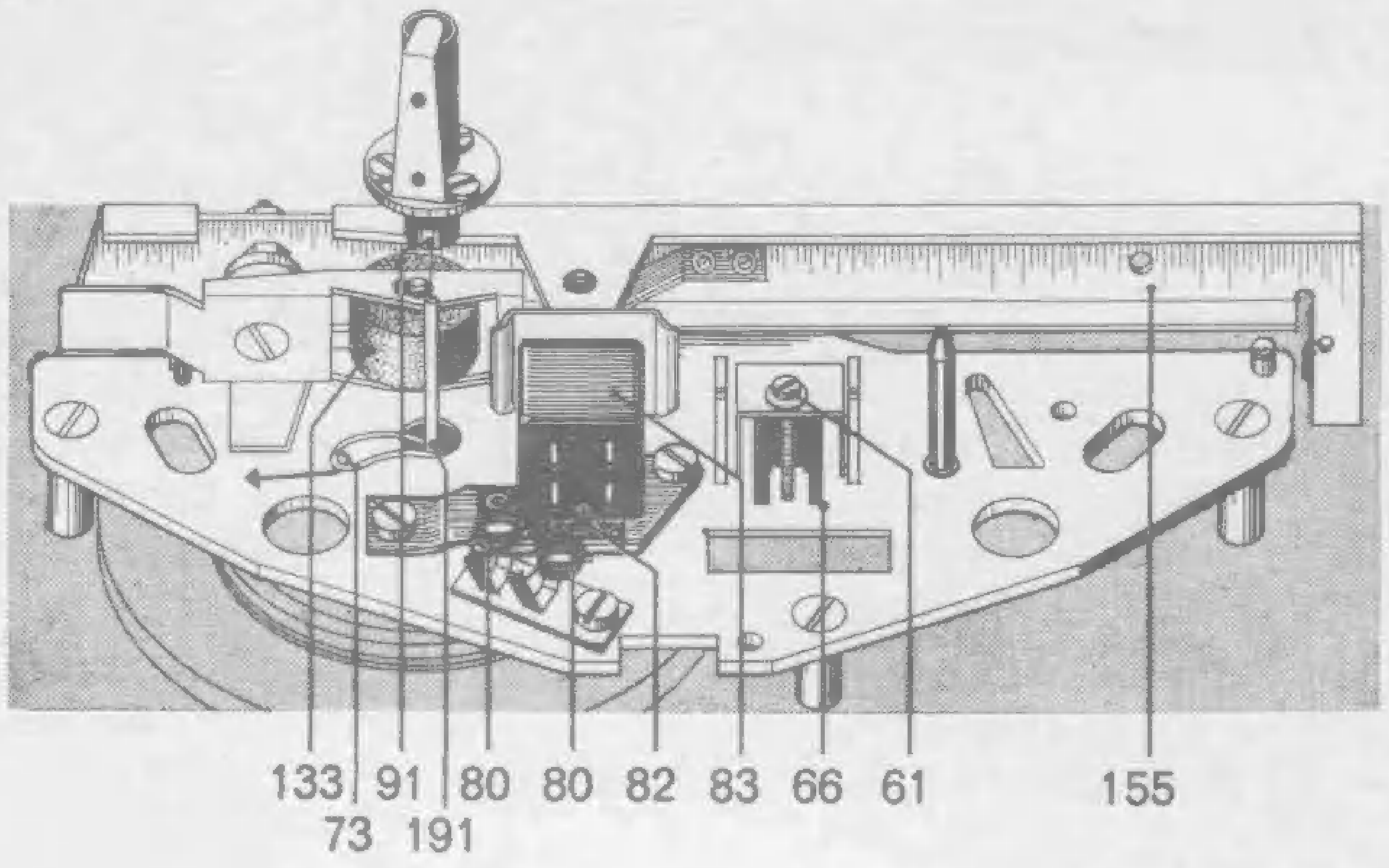


Fig. 7

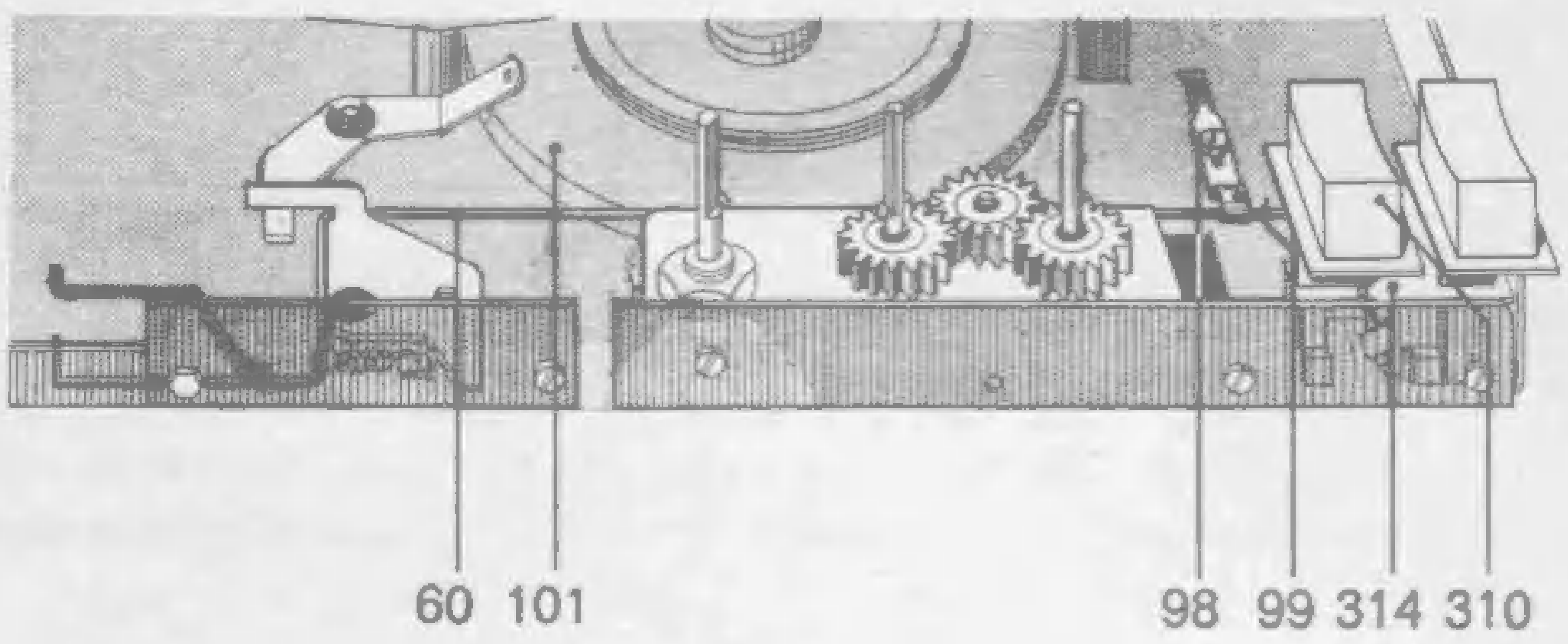


Fig. 8

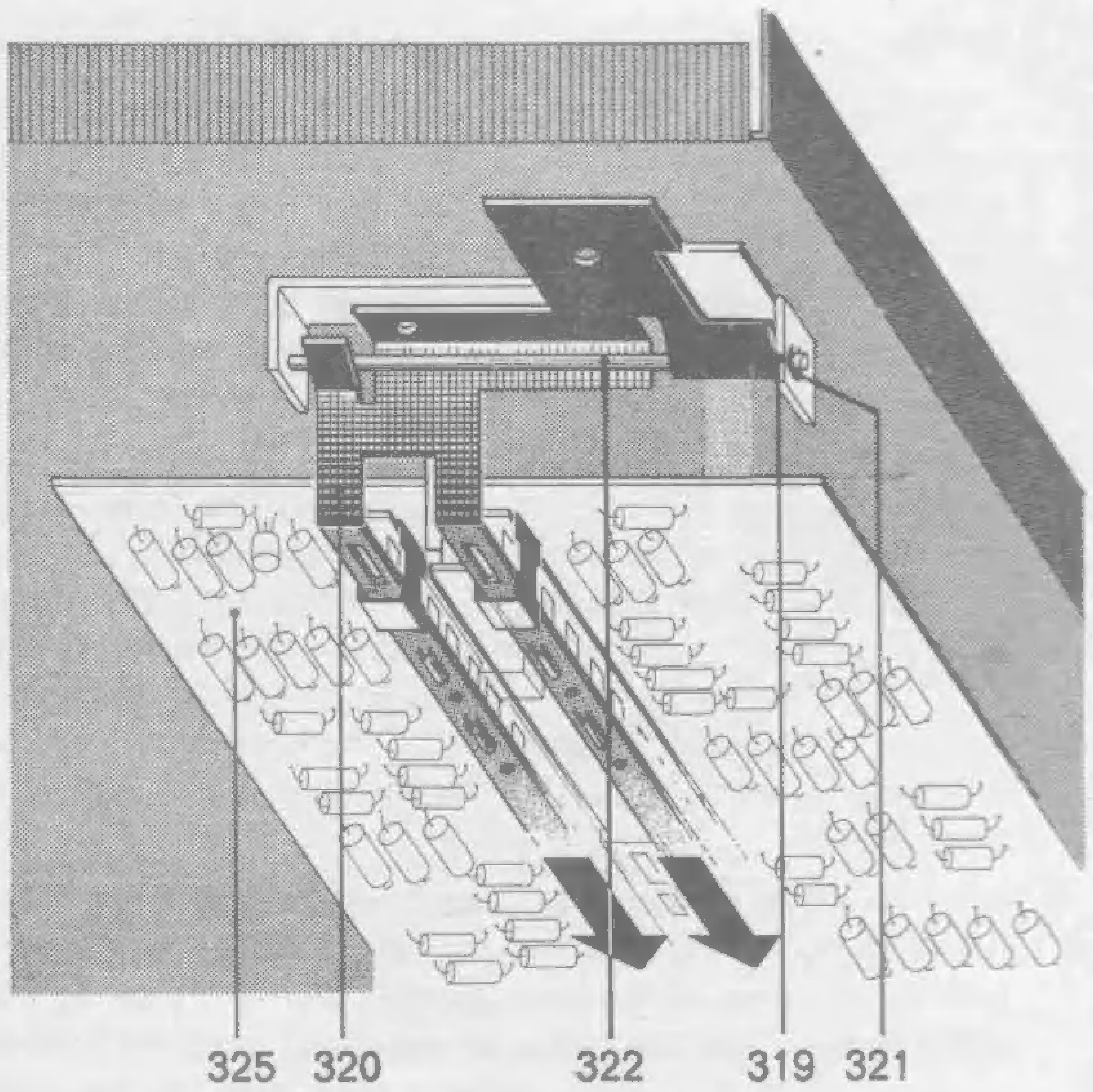
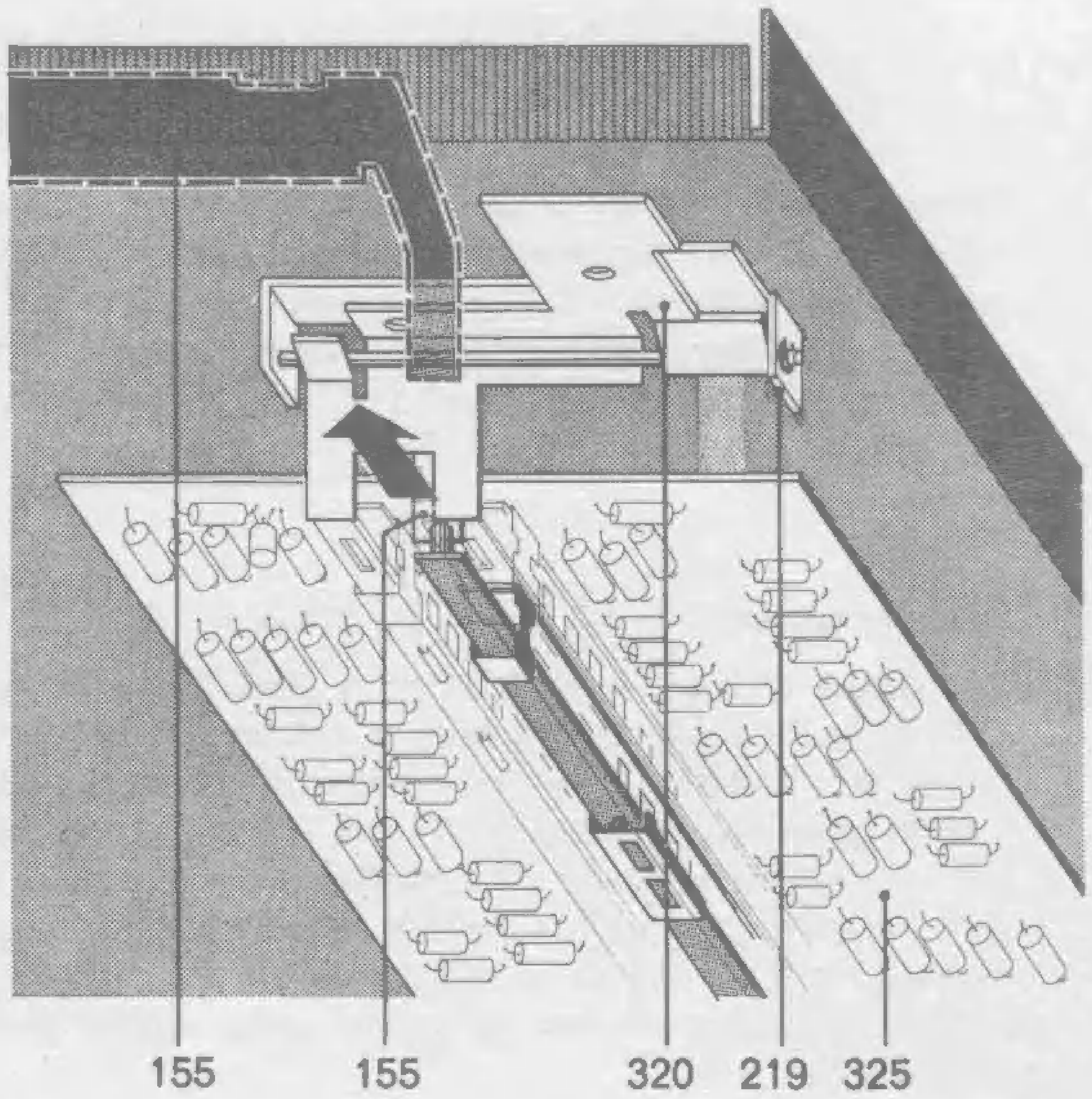


Fig. 9



13. **Fast forward and rewind**

The critical operational condition for rewinding is brought about when a 7" take-up reel is almost full. Care must be taken that the tape guide posts of the unit as well as the rubber friction wheels are clean.

14. **Take-up reel**

The take-up reel takes up the tape transported from the capstan via a sliding coupling (friction clutch). Drive and sliding coupling must work completely without jerks or jolts, in order to eliminate wow and flutter. The engagement of the take-up reel (89) can be adjusted by bending the hang-in tab (L) for the control wire (239) at the rocker lever (168). At "Stop", the drive bushing (90) must be visibly disengaged from the tape spindle. When the c-ring (110) is placed on the shaft of the take-up reel (89), care must be taken that it is clamped firmly on the shaft of the lever (240). If this is not the case, bend the c-ring slightly together prior to mounting it. The c-ring must not rotate during play. The running surface between c-ring (110) and plastic cover (111) must be greased.

15. **Position of the pressure lever and the pressure bracket**

During operation the pressure lever (155) must lightly touch the left black bolt (B 1) on the head mounting plate (93). At the right bolt (B 2), a distance of approximately 0.5 mm is sufficient. Adjustment is made by aligning the pressure lever (155) or the bronze spring of the rocker lever (204) respectively.

The centering screw (149) of the pressure angle (150) must leave a secure free play (tolerance) for the pressure angle (150).

16. **Tape shut-off**

The tape shut-off is adjusted with screw (50). After the screw (50) has been twisted, it is necessary to secure it well by means of screw-securing varnish. The adjustment is correct if the shut-off mechanism engages at approximately the final 4 mm of the feeler pin path.

17. **Cementing tip**

In case cement joints have become loose, methylene chloride or trichlor ethylene (trilene) should be used to cement the keys on the plastic clamping pieces. To cement the tape counter window, the plastic parts on the sides, the volume control instruments and the escutcheons, use contact glue.

18. **Lubricating**

The unit is sufficiently lubricated at all its bearings and sliding surfaces at the factory. Under normal working conditions, it would not be necessary to relubricate for years, since the most important bearing points are equipped with sintered bearings.

Bearing points and sliding surfaces should be lightly lubricated. It is very important that no oil or grease get on the rubber running surfaces and rubber belts, since they would be destroyed. Touching these parts with one's hands must, for some reason, also be avoided.

RECOMMENDED LUBRICANTS.

For all bearing points:
BP oil Visco Static.
For all friction and sliding surfaces:
Shell grease A.

Mixing of various lubricants often results in chemical decomposition. Use original lubricants.

Fig. 10

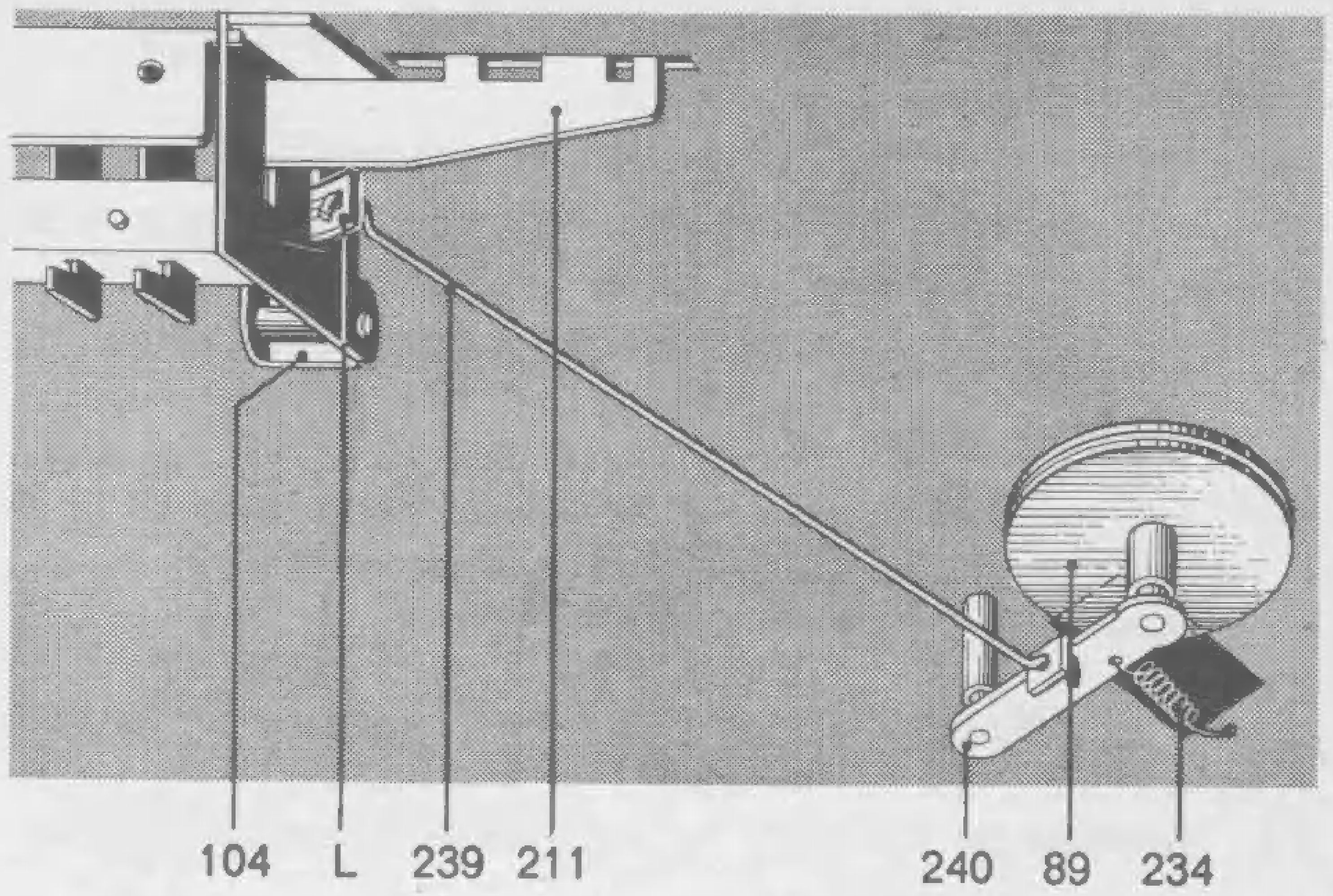


Fig. 11

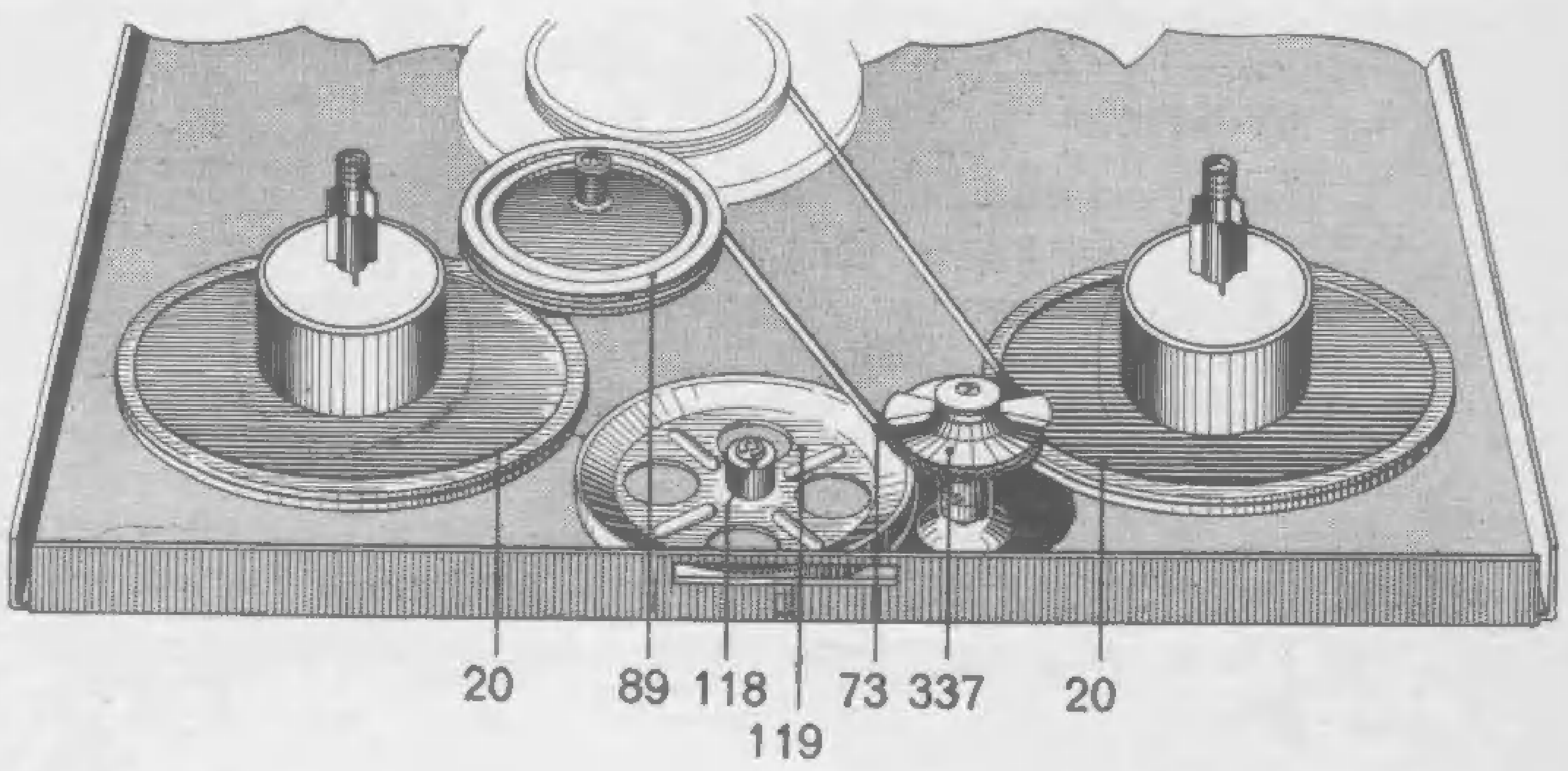


Fig. 12

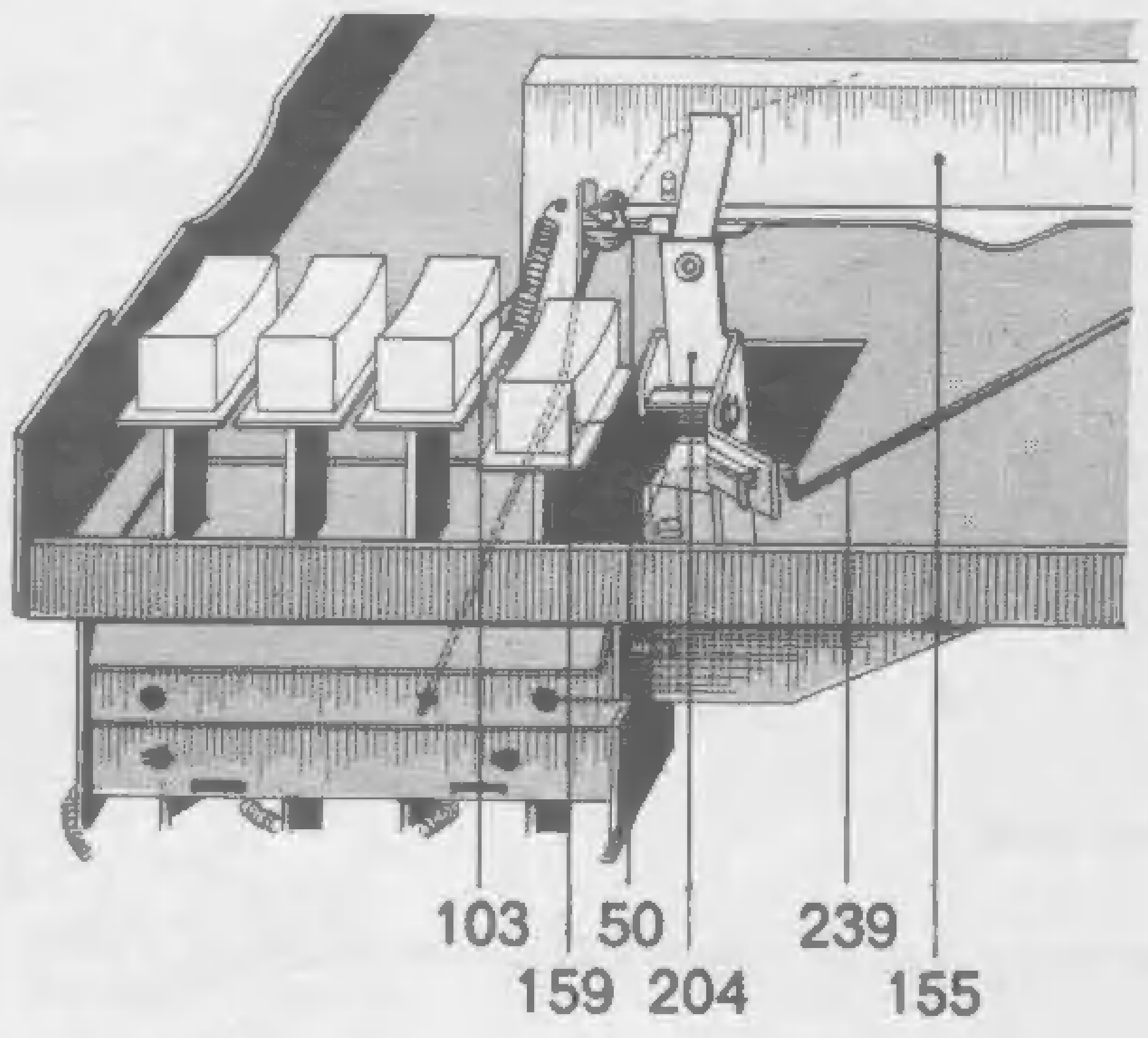
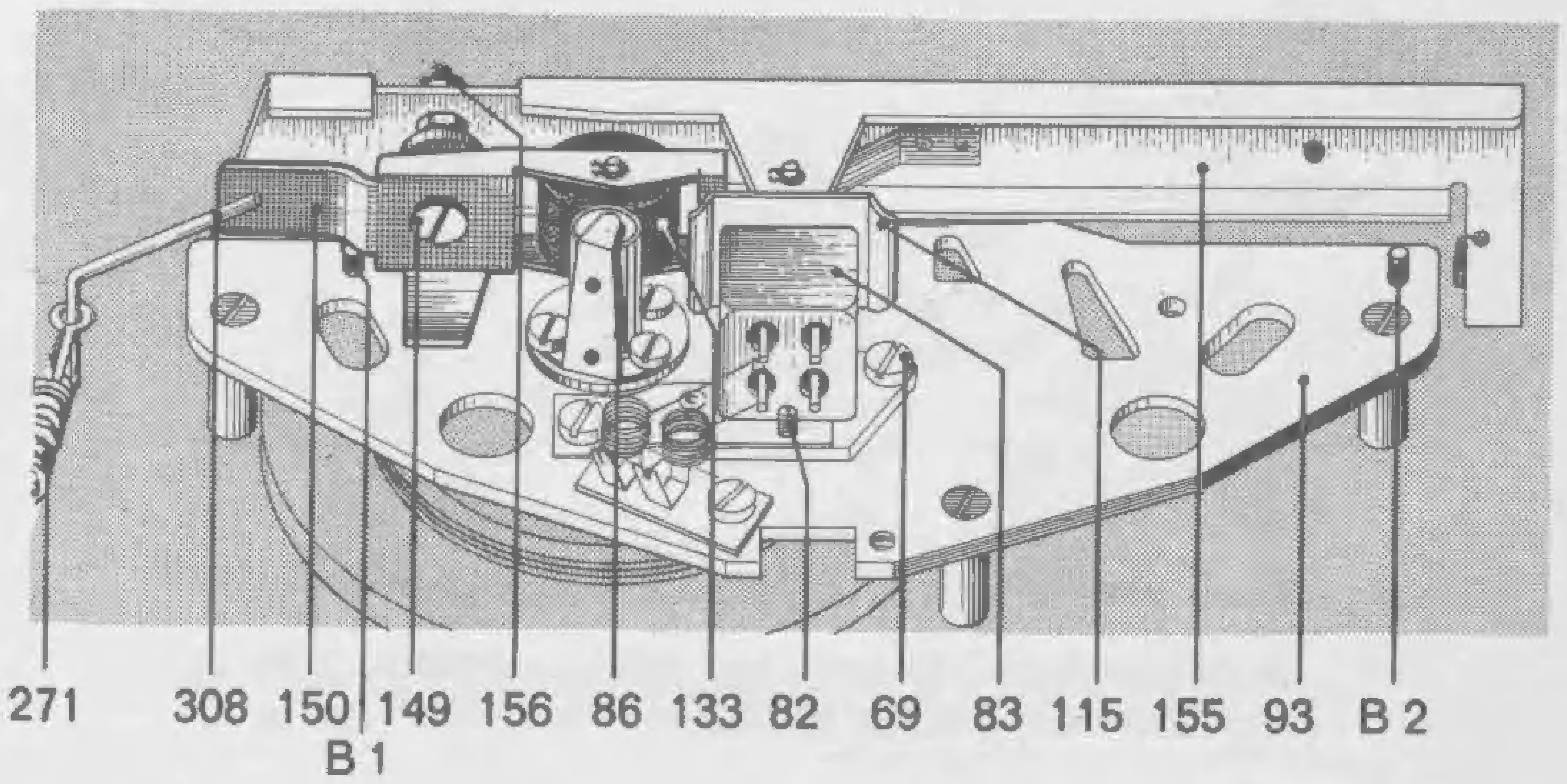


Fig. 13



b) Electrical section

1. **Test conditions:**

All adjustments should be made at the same line voltage and frequency at which the unit is to be operated.

2. **Test instruments:**

Amplifier Voltmeter

for low and high-frequency measurements with $R_i \geqq 1$ megohm and an upper frequency limit $>$ 100 kHz, lowest required measuring range 10 mV.

Generator

up to 20 kHz for frequency response measurements, perhaps up to 100 kHz for high-frequency measurements.

Distortion meter

to adjust the volume indicator at f = 333 Hz.

Oscilloscope

with frequency response up to approximately 1 MHz for checking low and high-frequency waveform as well as noise voltage.

Multimeter

Use 1 Kohms per volt to measure line voltage. If necessary, high-frequency measurements can be made by comparison of the frequency used and an audio generator with oscilloscope.

Standard tape

for all recording and playback adjustments. Dual standard tape 9 (KDW 221) for 3¾ i.p.s. tape speed.

The tape contains in full-track recording at 3¾ i.p.s. tape speed:

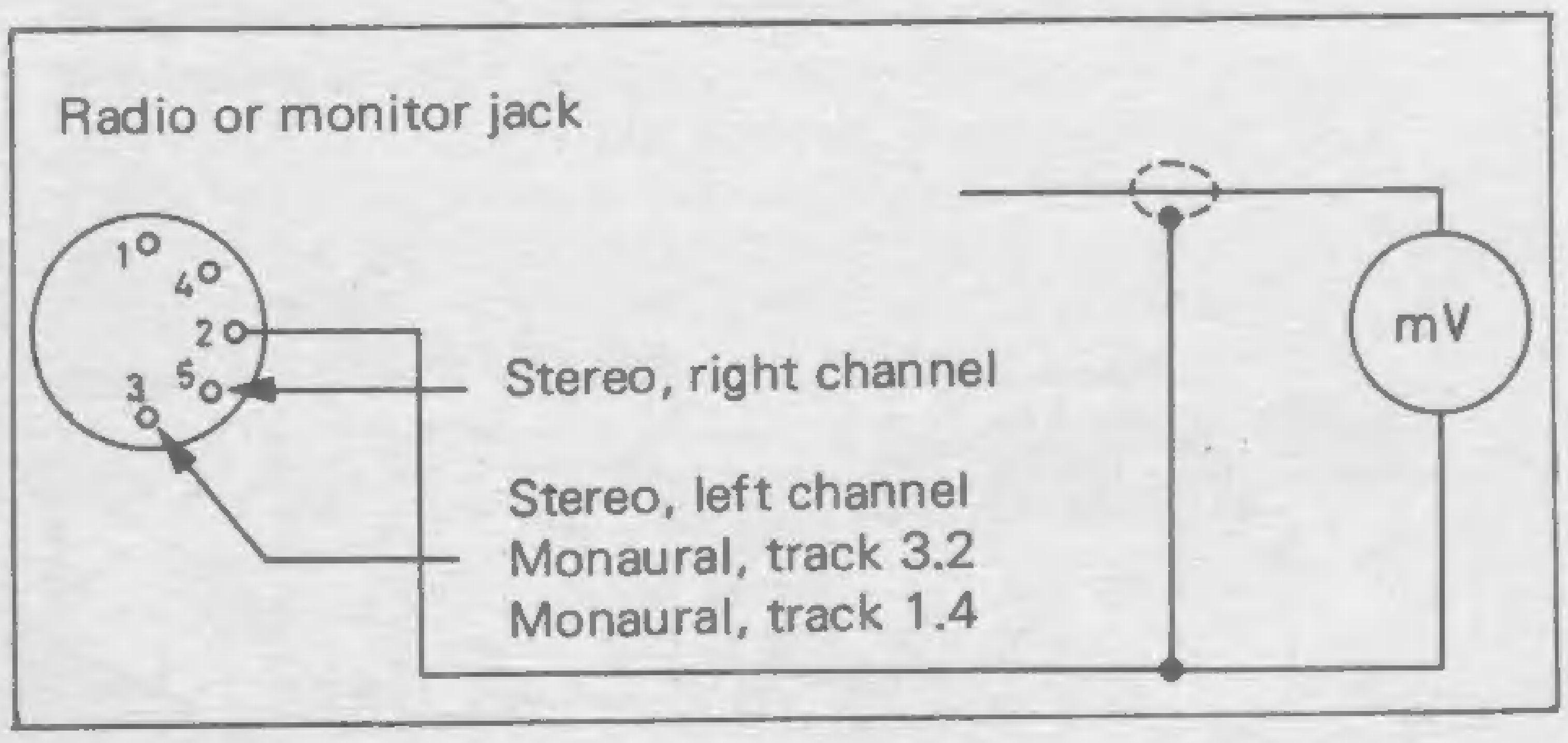
1. Yellow leader:
   polishing tape, connecting section for track adjustment.
2. Blue leader:
   DIN level 333 Hz.
3. Gray leader:
   Frequency response section 10 kHz, – 20 dB compared with DIN standard level 333 Hz at a tape flow $\tau = 90$ µs.
4. Red leader:
   DIN blank tape section.

3. **Current consumption**

220 V., 50 Hz., approximately 150 ma
110 V., 50 Hz., approximately 300 ma
117 V., 60 Hz., approximately 240 ma

4. **Playback:**

4.1 **Hook-up for playback measurements.**



4.2 **Equal level of both channels and output level**

Switch unit to 3¾ i.p.s. and stereo playback. Play at DIN standard level 333 Hz of the Dual standard tape 9.

Adjust R 204 on the printed circuit board underneath the shield to equalize level (R 204 controls the amplification of the right channel).
The output level must be:
$U_{\text{standard level}} \geqq 400$ mV

4.3 **Stray noise** (hum)

For playback operation load tape and press "START" and "PAUSE" so tape will not move. Stray noise at "RADIO" jack:
$U_{\text{stray noise}} \leqq 5$ mV

This is applicable for any position of the operating mode selector. Stray noise can be adjusted after breaking the seal of the compensation (humbucking) coils behind the playback head by readjusting same. Then, glue on coils firmly with UHU glue.

4.4 **Playback frequency from standard tape**

Switch unit to 3¾ i.p.s. and stereo playback.
Use Dual standard tape 9 ($\tau = 90$ µs)

1. Play DIN standard level 333 Hz and note level.
2. VU meter 20 dB down.
3. Play 10 kHz tone and compare 10 kHz level of both channels with the 333 Hz standard level. By lowering the VU meter the level leap of the two frequency recordings has been taken into consideration; approximately the same reading must be achieved.

Permissible deviations:

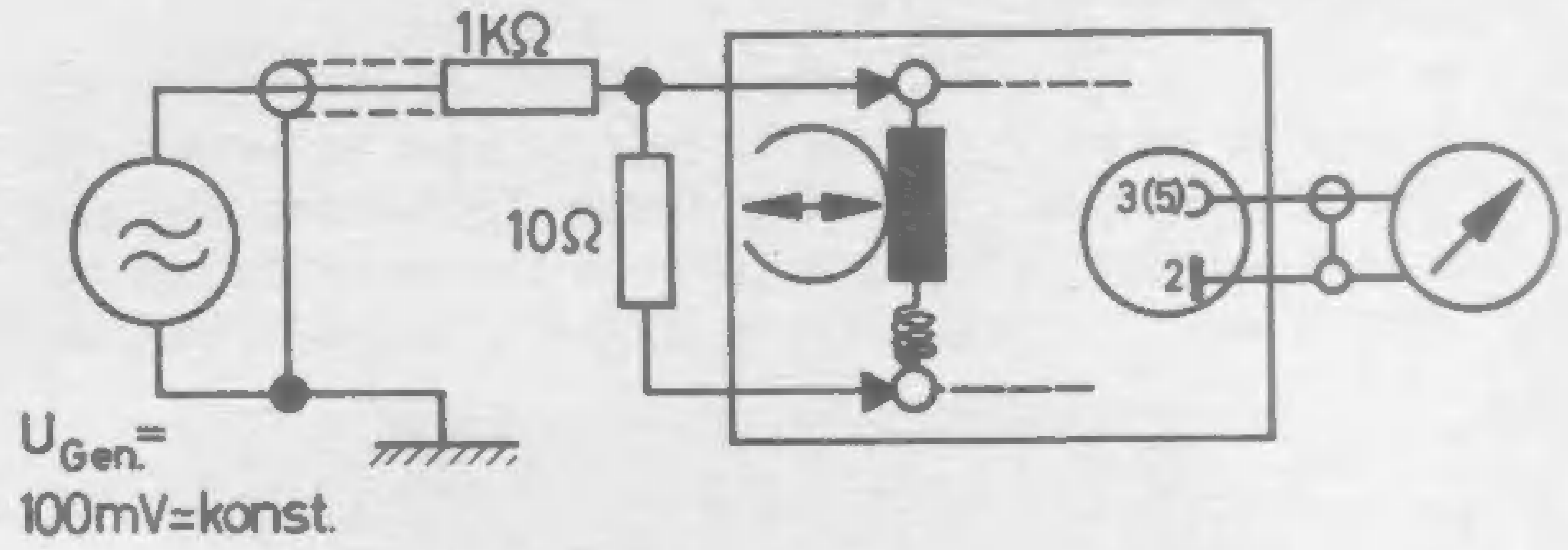
$$\frac{333\text{ Hz}}{10\text{ kHz}} = +2; -5\text{ dB}$$

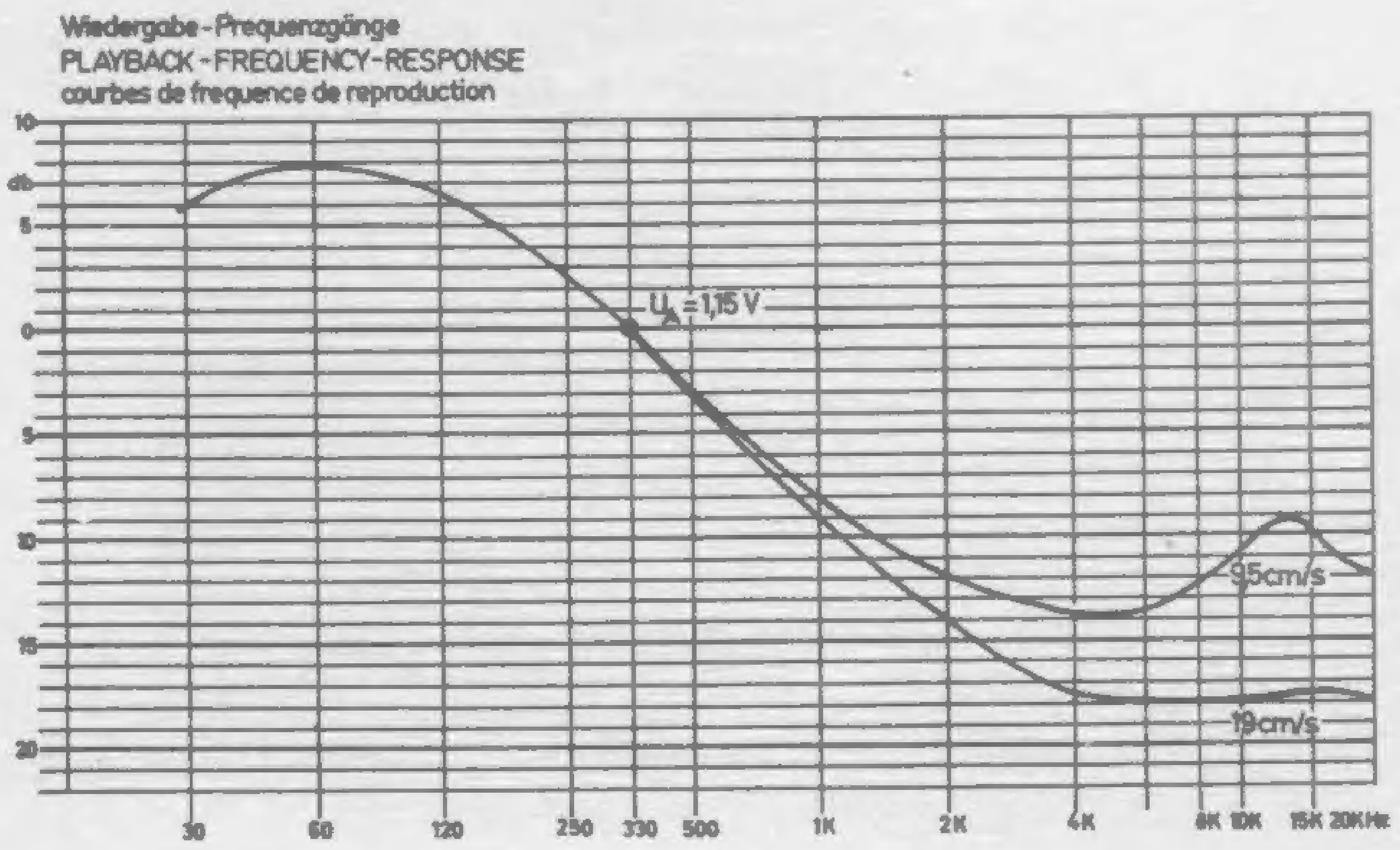
The 10 kHz recording (tone) is very sensitive so that even with a slightly used standard tape, a slightly higher 10 kHz level drop may occur.

4.5 **Playback frequency response and playback amplification**

Switch unit to appropriate speed, stereo playback and press "START". Remove drive belt to avoid engaging of tape-end shut off. Switch tone generator via voltage divider directly parallel to the corresponding playback head.

Frequency response and amplifications shown on the diagram below must be within a ± 2 dB.





5. High-frequency selection:

5.1 Pointers and procedures

5.1.1 High-frequency voltage measurement by means of V.T.V.M. with shielded test leads not longer than three feet.

5.1.2 For high-frequency levelling, turn trimming condensers (C 115 and C 125) into center position.

5.2 Generator frequency: 95 kHz.

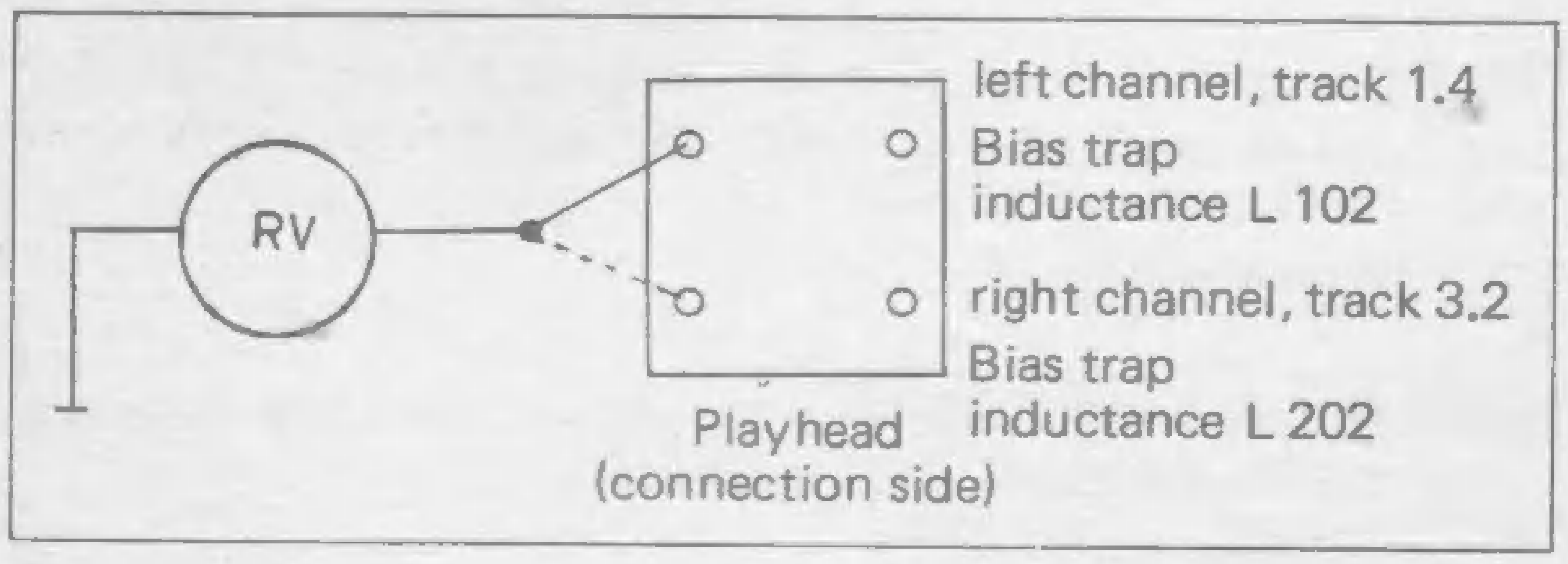
5.2.1 Adjust the oscillator coil to the audio generator frequency. The track selector must be switched to "stereo".

5.2.2 The measurement is carried out by means of frequency comparison. The erase head voltage is fed in at the y-input of an oscilloscope, and 95 kHz of a generator are placed at the x-input. At the core of the oscillator coil located within the unit, levelling must take place until a circle or an eclipse appears.

5.3 High-frequency bias trap with L 102 and L 202

Switch to "Stereo Record" position. Measure the high frequency voltage with a V.T.V.M. directly at the corresponding playhead.

The traps are adjusted to the high frequency for maximum voltage for the pertaining playhead.



5.4 Erase-head-dummy inductance L 3 levelling

Place unit in mono record, track 1 – 4, or track 3 – 2. Level L 3 (at the operation mode selector) to voltage maximum at the corresponding playhead system (measurements as with 5.3). When switching from mono to stereo, the high frequency voltage at the playhead must not change by more than ± 1 dB.

5.5 HF Pre-magnetization

The HF Pre-magnetizing has a decisive influence on the recording frequency response and distortion. Adjustment according to 6.3.

6. Recording:

6.1 Procedure directives

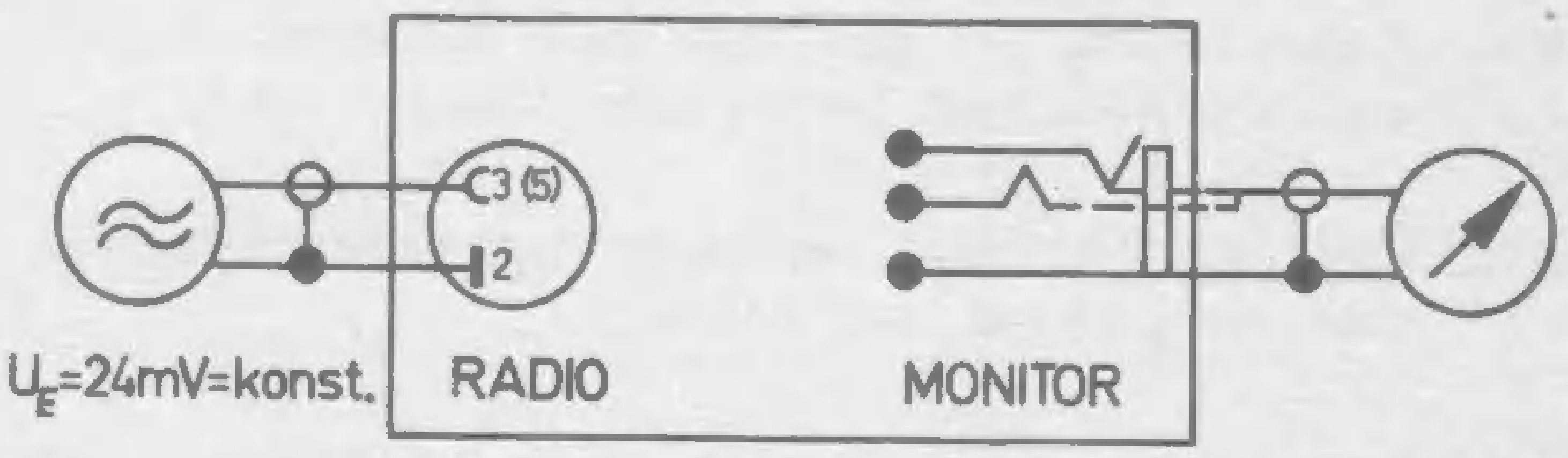
6.1.1 Feeding from the Audio Oscillator occurs into the phono input of the "RADIO" jack.

In case of units with RCA jacks, feeding occurs from the audio oscillator to the jacks INPUT I and INPUT II.

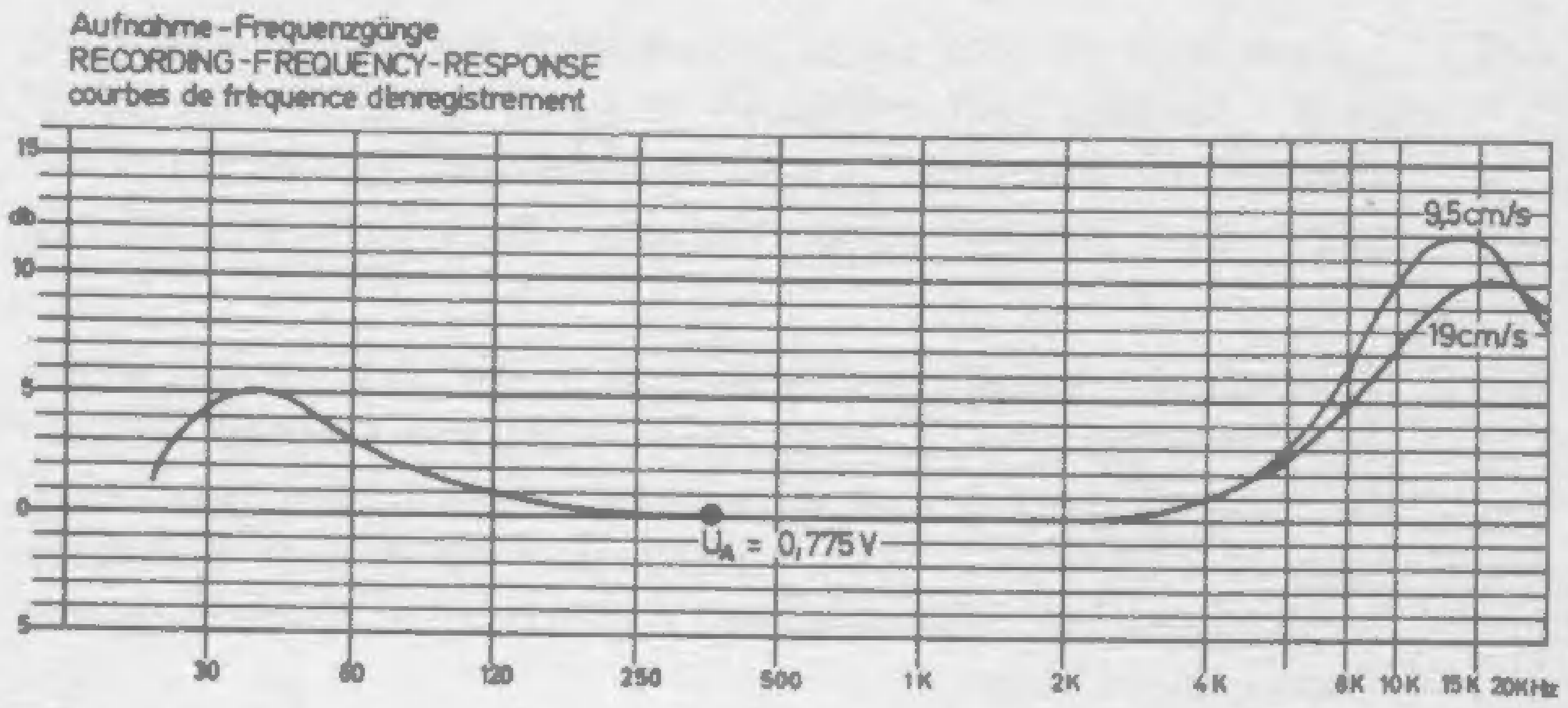
6.1.2 In case of a completely new levelling of the recording channels, Trimmer R 127 must first be brought in center position at the operation mode.

6.2 Amplifier frequency response

Place unit at corresponding speed and stereo recording. Switching according to 6.1.1, volume control at maximum. The following frequency response and amplification as shown on the diagram below must be achieved within a tolerance of approximately ± 2 dB.



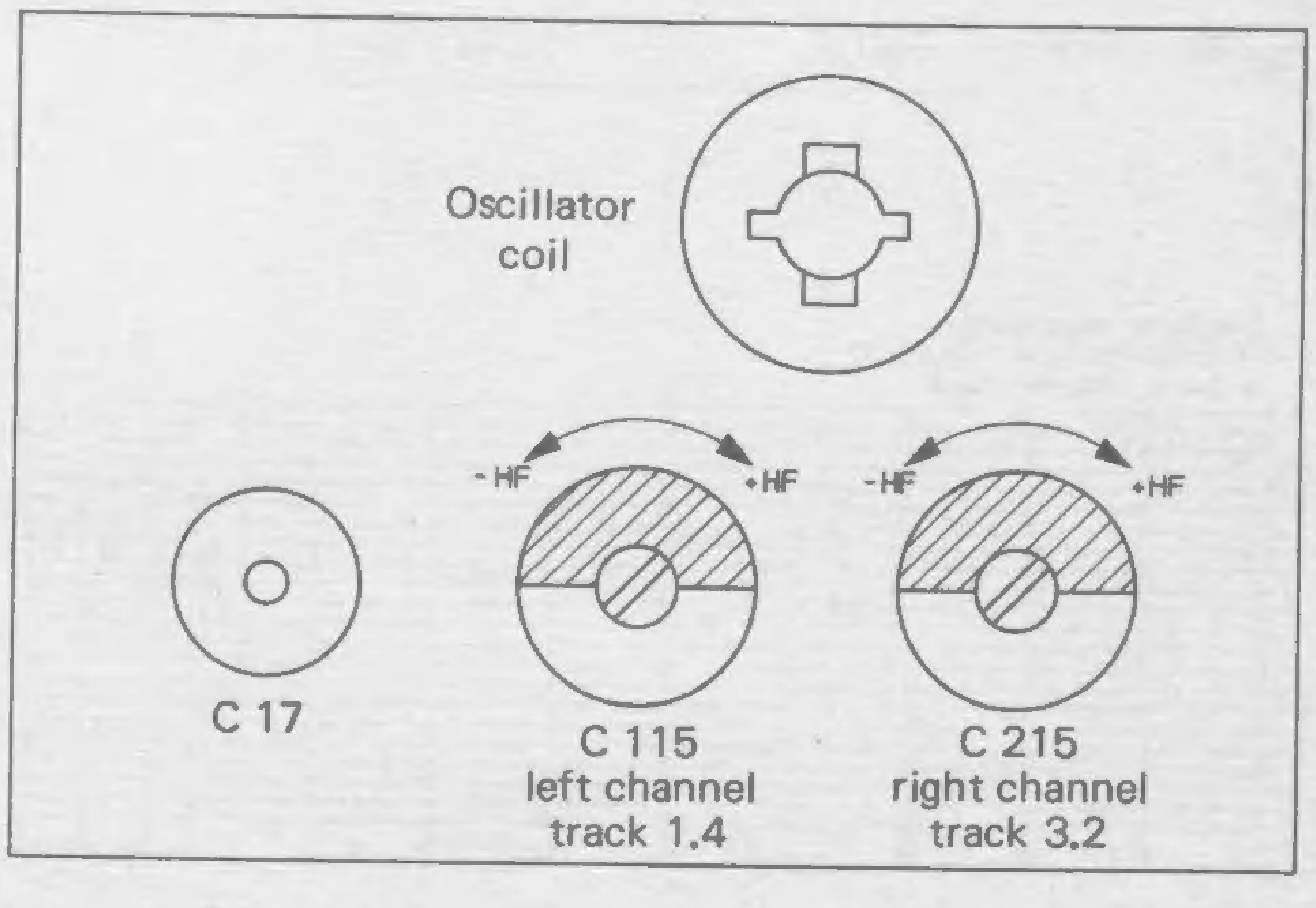
Löschkopf kurzgeschlossen
ERASING HEAD SHORTED
Tête d'effacement court-circuitée



6.3 Pre-magnetizing adjustment

6.3.1 Place unit at 3¾ i.p.s. tape speed and stereo; volume control at maximum. Switching according to 6.1.1. DIN blank tape section (Dual standard tape) placed on.

In case of complete new levelling, start from center position of the trimming condensers.



6.3.3 Record 333 Hz and 10 kHz with Ue = approximately 5 mV = const., then compare the two playback levels of the two frequencies. If no level equality exists, then the HF-pre-magnetizing must be corrected.

Less HF brings about increased high frequency (and increased distortion).

More HF brings about decrease in high frequency (and lower distortion).

Repeat this until level is equal.

6.4 Level equality for stereo recording

6.4.1 Switch unit to 3¾ i.p.s. tape speed and stereo. Volume control at maximum. Switching according to 6.1.1.

6.4.2 Make 333 Hz stereo recording, then compare the play back levels of the two channels.

6.4.3 Since the vacuum tube voltmeter at the "Monitor" jack indicates also the recording level, only the level of the left channel can, according to its deviation, be corrected at R 127 (mode selector switch).

6.5 Volume control indicator

6.5.1 Switch unit to 3¾ i.p.s. tape speed; switching according to 6.1.1, feed both channels in parallel; distortion meter instead of vacuum tube volt-meter is connected. DIN blank tape section (Dual standard tape 9) is placed on.

6.5.2 Operational mode selector switch in stereo position. Make 333 Hz recording, with 0 dB level at the volume control instrument. In case of complete readjustment, turn controls R 114 and R 214 on the printed circuit board to center position. Measure the distortion of both channels when playing back.

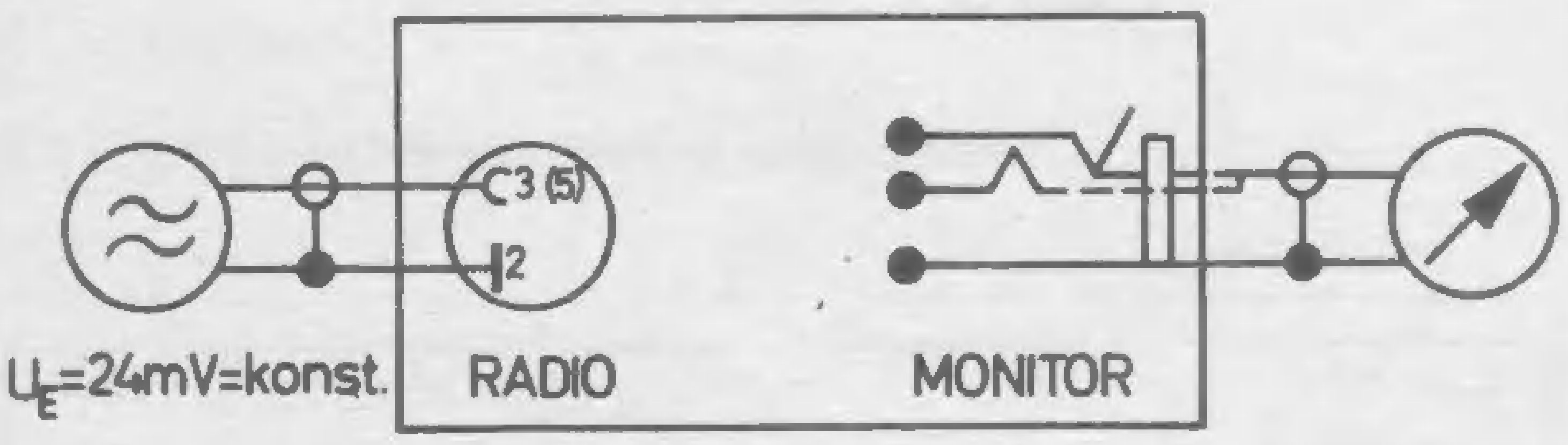
6.5.3 Vary recording level until playback for the lesser channel is K = 5 %.

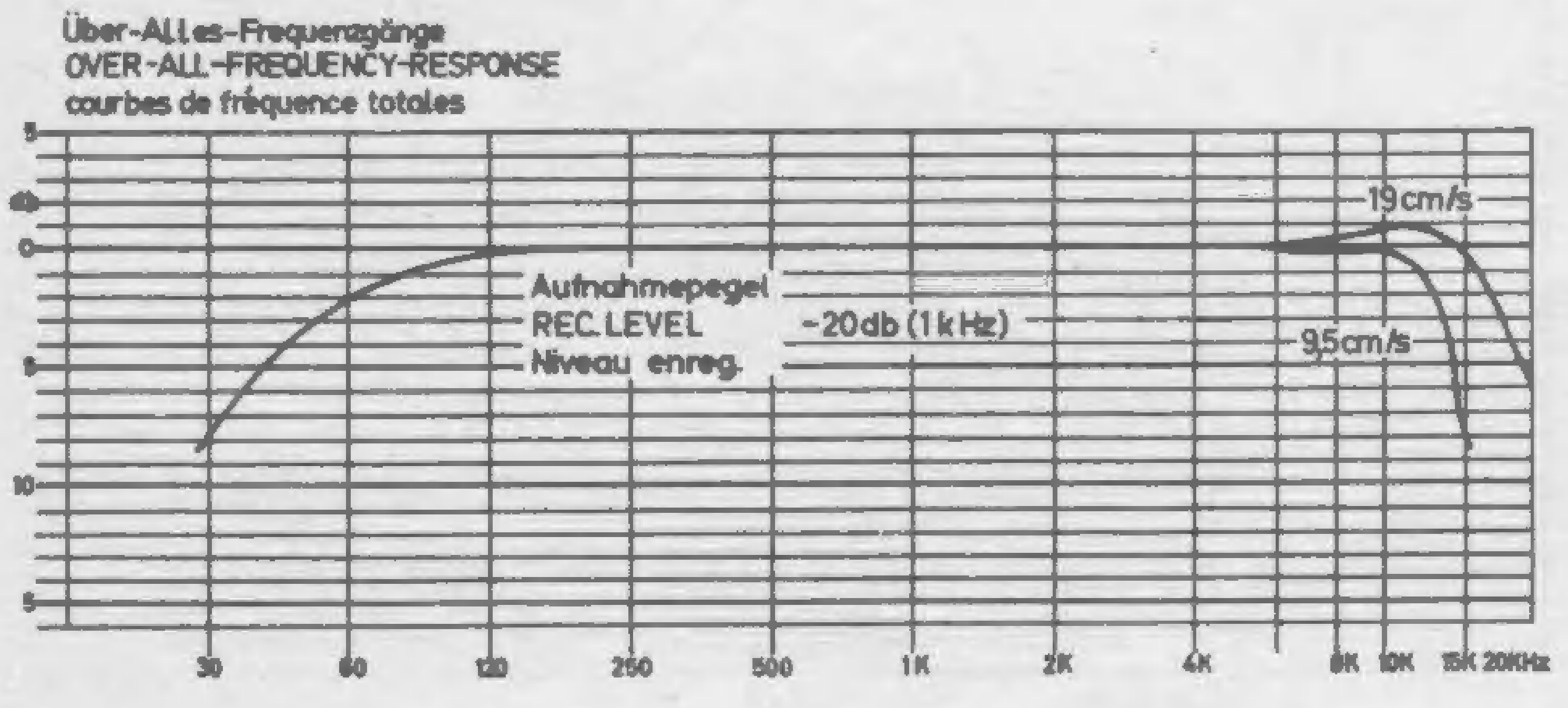
With this position, switch back once more to recording and place the volume control instruments at R 114 and R 214 to 0 dB.

7. Over-all frequency response:

Switching according to 6.1.1. Switch unit to stereo. DIN blank tape section (Dual standard tape 9) placed on.

Ue = 5 mV = const.





8. Play head replacement and adjustment:

8.1 The new play head is supplied complete with shielding and rocker.

CAUTION: In the lower part of the rocker there is a ball, which is a special part of any play head and which determines the exact track level of the play head. This makes an adjustment of the track level unnecessary.

Do not replace ball arbitrarily.

The play head is screwed on in such a manner that it is arranged as vertically as possible.

8.2 Thereafter, the tape guide system is adjusted at the set screw behind the rocker in such a manner that a proper double play or triple play tape, upon start function, passes smoothly through the tape guide at the capstan bearing. The tape must not show any inclination to buckle at it edges, even at good lighting. Depress start key several times and check the adjustment with a second tape.

8.3 The vertical positioning of the head slot is done with an adjustment screw on the left beside the play head so that for both playhead systems, upon playback the same relative loss to the corresponding voltage maximum occurs. To achieve this, the following should be done:

8.3.1 Vacuum tube voltmeter connected to jack "RADIO" (contact 3–2).

8.3.2 Operational mode selector switch switched to 1–4 for upper play head system.

Turn adjustment screw to maximum voltage and note position of screw slot.

8.3.3 Operational mode selector switch to be switched to 3–2 for lower playhead system and adjustment screw to be rotated to voltage maximum;

Note direction of rotation.

8.3.4 Now turn back adjustment screw at a half angle between the 1st and 2nd screw slot adjustment.

8.4 The following electrical adjustments are required:

Playback level equality	according to 4.2
Stray noise	according to 4.3
Pre-magnetizing adjustment	according to 6.3
Level equality for stereo recording	according to 6.4
Volume lever indicator	according to 6.5

9. Replacement of erase head

9.1 When screwing on the new head, care must be taken that tape winds properly. Tighten screw just enough to avoid warping of the plastic casing. Secure screw by means of varnish. Over-all frequency response at 3¾ i.p.s. and stereo for both channels must be checked. If the frequency response does not keep within the field of tolerance, the pre-magnetizing must, according to 6.3, be readjusted. Check volume control indicator according to 6.5.

10. Oscillator coil replacement:

10.1 After exchange of the oscillator coil, HF adjustments according to 5 are required.

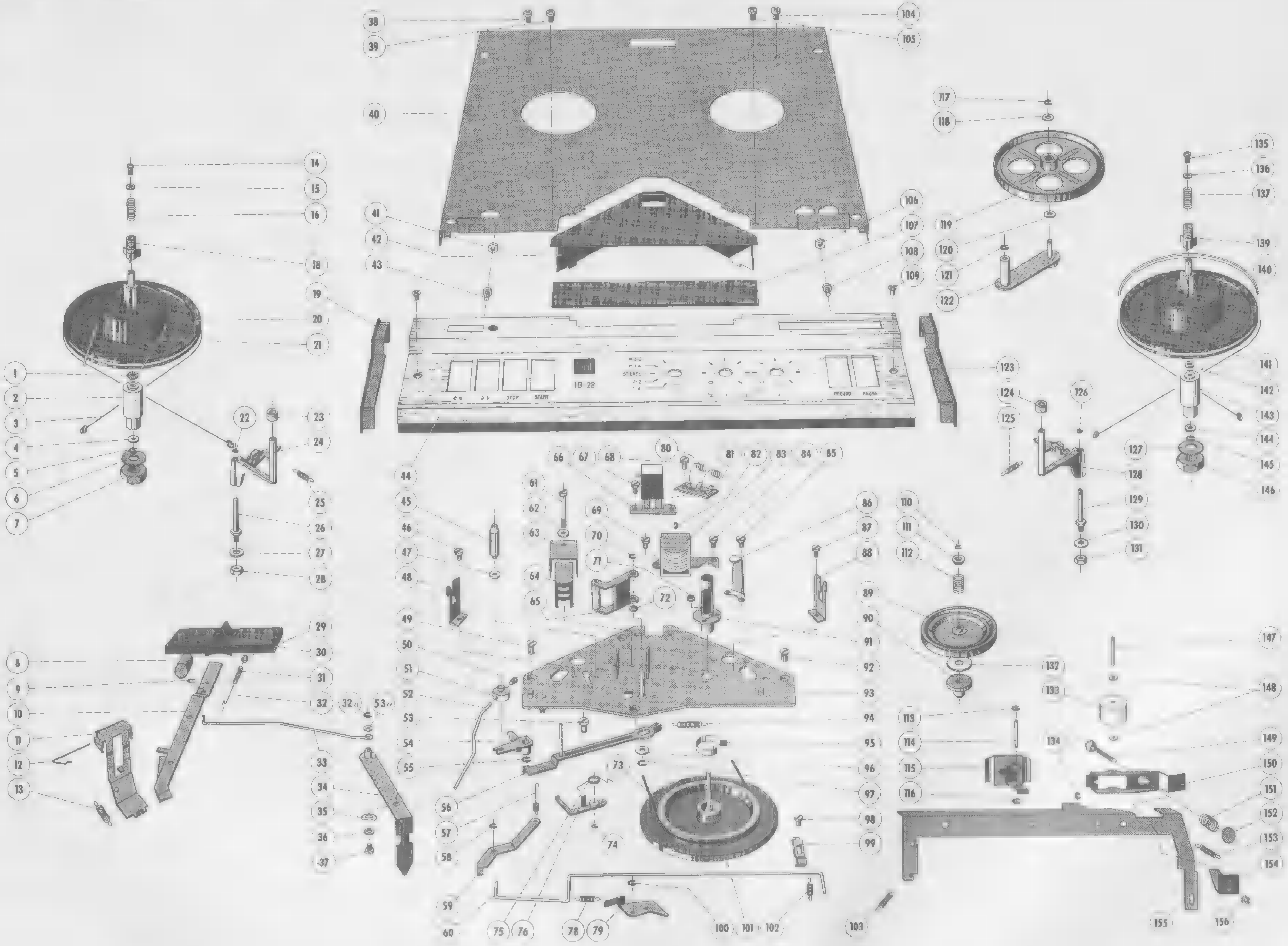
11. Transistor replacement:

In case of replacement use:
Tr. 101 / Tr. 201 : BC 109 C, BC 173 C, BC 149 C
Tr. 102 / Tr. 202 / Tr. 103 / Tr. 203:
BC 108 C, BC 172 C, BC 148 C
Tr. 4: BC 107 B.

Replacement parts

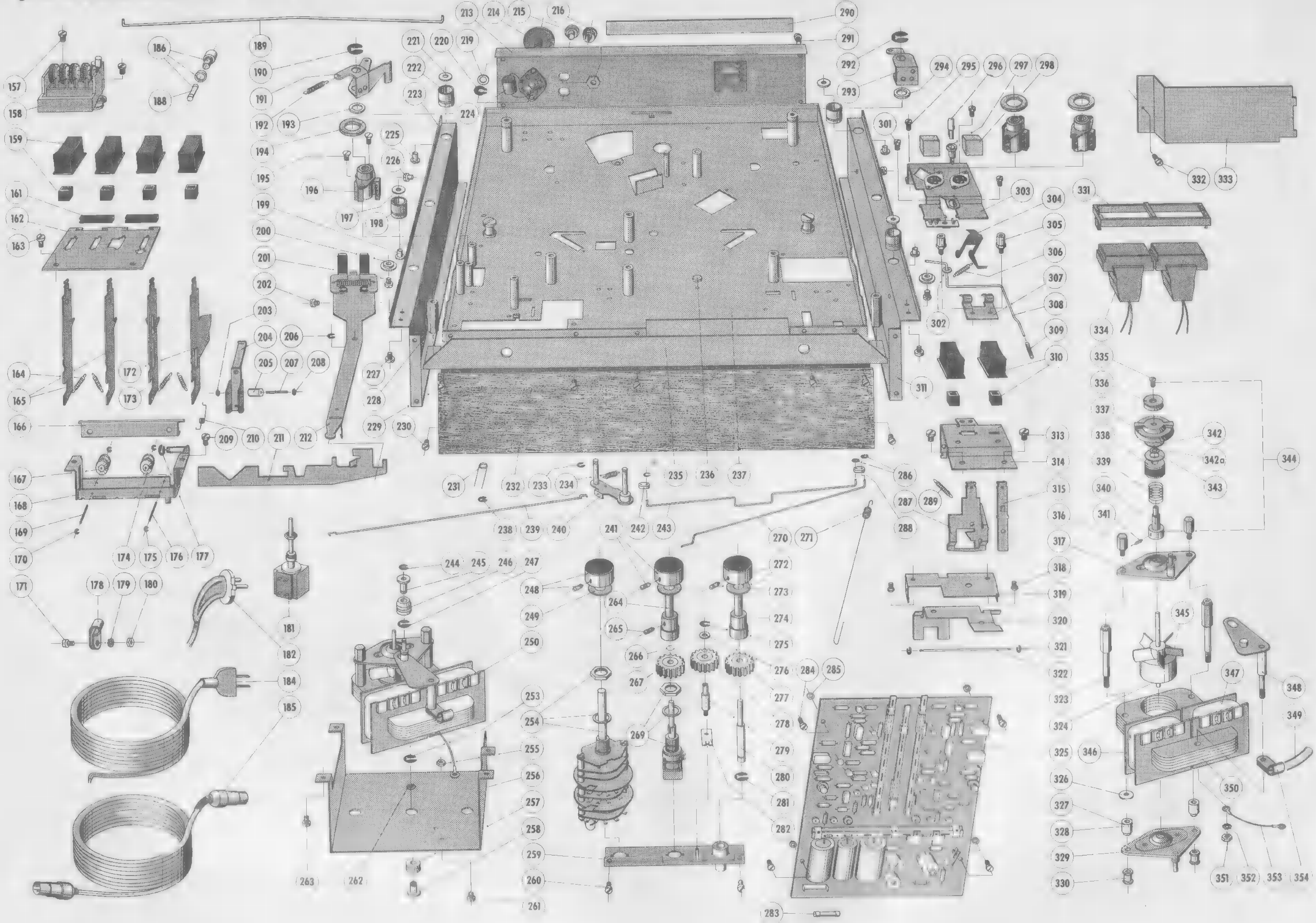
Pos. no.	Part no.	Description	Parts per set	
1	210 591	washer	4	
2	214 263	bearing ass'y	2	
3	205 484	brake cord ass'y	2	
4	210 591	washer	4	
5	210 145	c-ring 2.3	9	
6	210 717	washer	2	
7	210 371	hex nut M.10.	2	
8	214 395	pressure bolster	1	
9	210 194	retainer ring G 2 x 0.6	4	
10	205 725	shift lever	1	
11	214 494	shift fork with guide rod complete	1	
12	214 390	guide rod	1	
13	205 722	tension spring	1	
14	202 277	Phillips screw with cross head AM 2.6 x 5	2	
15	217 554	ring	2	
16	217 555	compression spring	2	
18	217 553	clamping sleeve	2	
19	214 405	side wall left	1	
20	214 488	rewind spindle ass'y	2	
21	214 361	counter belt	1	
22	214 319	safety ring	2	
23	209 940	rubber bushing	2	
24	218 018	brake lever left, complete	1	
25	205 689	tension spring	1	
26	214 313	shaft ass'y	2	
27	210 657	washer	3	
28	210 369	hex nut M 5	2	
29	203 476	washer	3	
30	214 491	switch slide with pressure bolster	1	
31	214 306	compression spring	1	
32	214 305	stop rod	1	
32 a	210 143	c-ring 1.5	8	
33	205 836	shift rod above	1	
34	204 976	switch angle II ass'y	1	
35	210 188	spring washer A 5	1	
36	210 597	washer	1	
37	210 480	machine screw AM 3 x 6	3	
38	210 292	Phillips screw with cross head AM 3 x 5	6	
39	210 292	Phillips screw with cross head AM 3 x 5	6	
40	214 407	dress plate ass'y	1	
41	210 361	hex nut M 3 x 4	2	
42	218 020	dress-up plus escutcheon	1	
43	210 292	Phillips screw with cross head AM 3 x 5	6	
44	214 400	front dress-up cover ass'y	1	
45	205 739	special screw	1	
46	210 472	machine screw AM 3 x 4	13	
47	203 477	washer	2	
48	206 051	tape guide left	1	
49	210 396	flat head screw AM 4 x 8	3	
50	210 453	machine screw AM 2.6 x 8	1	
51	214 331	adjustment bolt	1	
52	214 330	release rod	1	
53	205 762	special screw	1	
53 a	211 379	washer	1	
54	205 495	release lever ass'y	1	
55	210 146	c-ring 3.2	4	
56	214 326	stop plunger ass'y	1	
57	205 757	tension spring	1	
58	210 145	c-ring 2.3	9	
59	205 823	reverse lever II	1	
60	214 339	bias rod	1	
61	210 467	machine screw AM 2.6 x 22	1	
62	210 572	washer	1	
63	206 040	head shield	1	
64	206 130	erase head	1	
65	214 423	shut-off lever ass'y	1	
66	204 975	power switch key ass'y	1	
67	210 475	machine screw AM 3 x 5	7	
68	210 475	machine screw AM 3 x 5	7	
69	210 449	machine screw AM 2.6 x 5	1	
70	210 145	c-ring 2.3	9	
71	200 633	washer for capstan	1	
72	210 584	washer	1	
73	205 724	shift belt 21 MM Flach [illegible])	1	
74	210 143	c-ring 1.5	8	
75	205 755	torsion spring	1	
76	209 192	intermediate lever ass'y	1	
78	205 817	tension spring (to withdraw or pull back the bias rod)	1	
79	205 822	reverse lever I	1	

Fig. 14 Exploded view, parts above chassis plate



Pos. no.	Part no.	Description	Parts per set	
80	204 939	hum-bucking coil	2	
81	209 368	terminal board, 3 sections	1	
82	205 747	fine pitch set screw	1	
83	205 499	playhead with rocker ass'y	1	
84	210 469	machine screw AM 3 x 3	1	
85	210 475	machine screw AM 3 x 5	7	
86	214 325	tension spring	1	
87	210 472	machine screw AM 3 x 4	13	
88	206 052	tape guide right	1	
89	214 352	take up spindle	1	
90	214 349	drive bushing	1	
91	214 302	capstan bearing ass'y	1	
92	210 396	flathead screw AM 4 x 8	3	
93	214 324	head mounting plate complete with tape guide	1	
94	205 750	tension spring	1	
95	205 716	shift spring	1	
96	210 657	washer	3	
97	210 147	c-ring 4	2	
98	210 472	machine screw AM 3 x 4	13	
99	205 821	adjustment clamp	1	
100	210 145	c-ring 2.3	9	
101	214 489	capstan with flywheel	1	
102	205 820	tension spring (for pressure of bias rod)	1	
103	206 047	tension spring	1	
104	210 292	Phillips screw with cross head AM 3 x 5	6	
105	210 292	Phillips screw with cross head AM 3 x 5	6	
106	210 361	hex nut M 3 x 4	2	
107	216 530	dress-up strip	1	
108	210 292	Phillips screw with cross head AM 3 x 5	6	
109	210 342	Phillips screw with cross head AM 3 x 6	2	
110	210 142	c-ring 1.2	1	
111	214 359	plate washer	1	
112	214 358	compression spring	1	
113	210 143	c-ring 1.5	8	
114	205 775	shaft	1	
115	205 356	head flap ass'y	1	
116	210 143	c-ring 1.5	8	
117	210 145	c-ring 2.3	9	
118	210 591	washer	2	
119	214 369	intermediate wheel ass'y	1	
120	210 591	washer	2	
121	210 146	c-ring 3.2	4	
122	214 365	intermediate wheel lever ass'y	1	
123	214 406	side wall right	1	
124	209 940	rubber bushing	2	
125	205 689	tension spring	1	
126	214 319	safety ring	2	
127	210 717	washer	2	
128	218 019	brake lever right complete	1	
129	214 313	shaft ass'y	2	
130	210 657	washer	3	
131	210 369	hex nut M 5	2	
132	214 357	adhesive felt disc	1	
133	205 503	pressure roller	2	
134	210 144	c-ring 1.9	3	
135	202 277	Phillips screw with cross head LK 2.6 x 5.	2	
136	217 554	ring	2	
137	217 555	compression spring	2	
139	217 553	clamping sleeve	2	
140	214 297	friction ring	2	
141	205 484	brake cord ass'y	1	
142	210 591	washer	4	
143	214 263	bearing ass'y	2	
144	210 591	washer	4	
145	210 145	c-ring 2.3	9	
146	210 371	hex nut M 10	2	
147	205 643	roller shaft	1	
148	210 548	washer	2	
149	205 771	centering screw	1	
150	214 332	pressure angle ass'y with pressure roller	1	
151	205 772	compression spring	1	
152	205 773	cover	1	
153	205 659	tension spring	1	
154	205 774	tape disengage bracket	1	
155	214 420	pressure lever ass'y	1	
156	210 361	hex nut M 3	2	
157	210 486	machine screw AM 3 x 8	2	
158	214 490	tape counter ass'y	1	
159	217 604	push button ass'y with clamping piece	6	
161	214 284	damping profile	2	
162	214 282	push button plate ass'y above	1	

Fig. 15 Exploded view, parts below chassis plate



Pos. no.	Part no.	Description	Parts per set	
163	202 243	sheet-metal machine screw BZ 3.5 x 6.5	36	
164	205 658	tension spring	4	
165	214 276	rapid motion plunger ass'y	2	
166	214 275	stop latch	1	
167	205 640	roller	2	
168	214 272	push-button bracket ass'y	1	
169	214 274	shaft	2	
170	210 143	c-ring 1.5	8	
171	210 516	machine screw AM 4 x 8	2	
172	214 281	start plunger	1	
173	214 280	stop plunger	1	
174	205 640	roller	2	
175	210 143	c-ring 1.5	8	
176	214 274	shaft	2	
177	210 148	c-ring 5	3	
178	210 099	plastic clamp	2	
179	210 157	toothed washer	2	
180	210 366	hex nut M 4	1	
181	204 959	power switch push type	1	
183	204 713	power cord (German)	1	
184	200 601	power cord (USA)	1	
185	206 145	output cable ass'y	1	
186	214 794	fuse holder ass'y	1	
188	213 259	fuse 31.5 mA 250 V	2	
189	214 342	pull rod	1	
190	210 151	c-ring 7	2	
191	214 343	brake angle	1	
192	214 344	tension spring	1	
193	205 874	spacer ring	2	
194	214 527	cover washer	3	
195	210 382	flat head screw AM 2.9 x 6.5	2	
196	214 526	coaxial bushing 3-pole	1	
197	210 639	washer	4	
198	216 929	feed-through grommet	2	
199	213 298	tube rivet	4	
200	216 930	washer	2	
201	210 480	machine screw AM 3 x 6	3	
202	202 243	sheet-metal machine screw BZ 3.5 x 6.5	36	
203	210 144	c-ring 1.9	3	
204	205 467	rocker lever	1	
205	205 663	roller	1	
206	210 147	c-ring 4	2	
207	205 665	shaft	1	
208	210 144	c-ring 1.9	3	
209	210 475	machine screw AM 3 x 5	7	
210	205 656	torsion spring	1	
211	205 666	push button slide	1	
212	214 287	tilt lever ass'y	1	
213	214 506	back wall ass'y (standard jack)	1	
	214 520	back wall ass'y (cynch jacks)	1	
	214 522	cynch jack ass'y	4	
214	214 508	voltage selector ass'y	1	
215	214 794	fuse holder ass'y	1	
216	210 100	Heyco cable feed-through	1	
219	214 534	spacer ring	1	
220		retainer ring (contained in fuse holder)	1	
221	210 639	washer	4	
222	216 929	feed-through grommet	2	
223	216 928	side wall	2	
224	209 505	condenser 10 000 pF	1	
225	213 298	tube rivet	4	
226	202 243	sheet-metal machine screw BZ 3.5 x 6.5	36	
227	202 243	sheet-metal machine screw BZ 3.5 x 6.5	36	
228	214 261	supporting post	2	
229	202 243	sheet-metal machine screw BZ 3.5 x 6.5	36	
230	202 243	sheet-metal machine screw BZ 3.5 x 6.5	36	
231	205 668	hairpin spring	1	
232	214 391	bottom	1	
233	210 146	c-ring 3.2	4	
234	205 783	tension spring	1	
235	214 260	front rail	1	
236	214 262	grommet	1	
237	214 251	base plate ass'y	1	
238	210 146	c-ring 3.2	4	
239	205 782	guide wire	1	
240	214 345	lever ass'y	1	
241	214 549	rotary knob	3	
242	205 676	guide block	1	
243	206 013	switch rod	1	
244	210 145	c-ring 2.3	9	
245	214 268	upper bearing sleeve	1	

Pos. no.	Part no.	Description	Parts per set	
246	214 267	upper rubber bearing	1	
247	210 148	c-ring 5	3	
248	214 549	rotary knob ass'y	3	
249	203 239	felt ring	3	
250	214 492	motor ass'y	1	
253	210 148	c-ring 5	3	
254	214 504	track switch ass'y	1	
255	210 366	hex nut M 4	1	
256	214 269	mounting bracket	1	
257	214 270	lower rubber bearing	1	
258	214 271	lower bearing sleeve ass'y	1	
259	214 501	control bracket ass'y	1	
260	202 243	sheet-metal machine screw BZ 3.5 x 6.5	36	
261	210 516	machine screw AM 4 x 8	2	
262	210 157	toothed washer A 4.3	3	
263	210 472	machine screw AM 3 x 4	13	
264	214 528	coupling bolt	2	
265	210 226	threaded pin M 3 x 6	2	
266	204 988	spring washer	1	
267	204 964	gear ass'y	2	
269	213 198	potentiometer	1	
270	205 674	switch rod, short	1	
271	214 341	tension spring	1	
272	214 549	rotating knob	3	
273	203 239	felt ring	3	
274	214 528	coupling bolt	2	
275	210 197	retainer ring G 4 x 0.8	1	
276	210 630	washer	1	
277	204 964	gear ass'y	1	
278	204 985	gear	3	
279	204 981	intermediate shaft	1	
280	214 530	control shaft	1	
281	210 148	c-ring 5	3	
282	204 982	threaded flap	1	
283	213 259	fuse 315 mA 250 V	2	
284	210 480	machine screw AM 3 x 6	3	
285	210 567	washer	1	
286	210 194	retainer ring G 2 x 0.6	5	
287	214 336	recording plunger	1	
288	205 676	guide block	1	
289	214 337	tension spring	1	
290	214 509	inscription strip (Europe)	1	
	214 532	inscription strip (America)	1	
291	202 243	sheet-metal machine screw BZ 3.5 x 6.5	36	
292	210 151	c-ring 7	2	
293	205 872	reversing lever	1	
294	205 874	spacer ring	2	
295	202 243	sheet-metal machine screw BZ 3.5 x 6.5	36	
296	209 443	lamp 12 V 1 W	1	
297	209 441	mounting frame	1	
298	217 906	pressure bolster	2	
301	210 472	machine screw AM 3 x 4	13	
302	210 562	washer	1	
303	214 495	support bracket with connection jacks (Europe)	1	
	217 578	support bracket with connection jacks (America)	1	
304	214 518	lighting lever	1	
305	214 340	threaded post	2	
306	214 519	tension spring	1	
307	205 827	bearing clamp	7	
308	205 824	stop rod	1	
309	205 825	compression spring	1	
310	217 604	push key ass'y with clamping piece	6	
311	216 928	side wall	2	
313	202 243	sheet-metal machine screw BZ 3.5 x 6.5	36	
314	214 335	plunger guide	1	
315	214 338	fast stop plunger	1	
316	205 597	wrench head bolt	2	
317	214 377	upper bearing mount ass'y	1	
318	210 825	sheet-metal wrench head bolt B 2.9 x 6.5	1	
319	214 362	bearing bracket for switch angle I	1	
320	214 363	switch angle I	1	
321	210 145	c-ring 2.3	9	
322	205 021	shaft	1	
323	205 610	bearing post	2	
324	205 448	rotor ass'y	1	
325	214 545	amplifier-printed circuit board ass'y with components	1	
326	210 653	washer (according to requirement)		
327	216 966	short spacer bushing	2	
328	205 612	long spacer bushing	2	
329	214 374	lower bearing mount ass'y	1	
330	205 598	threaded bushing	2	

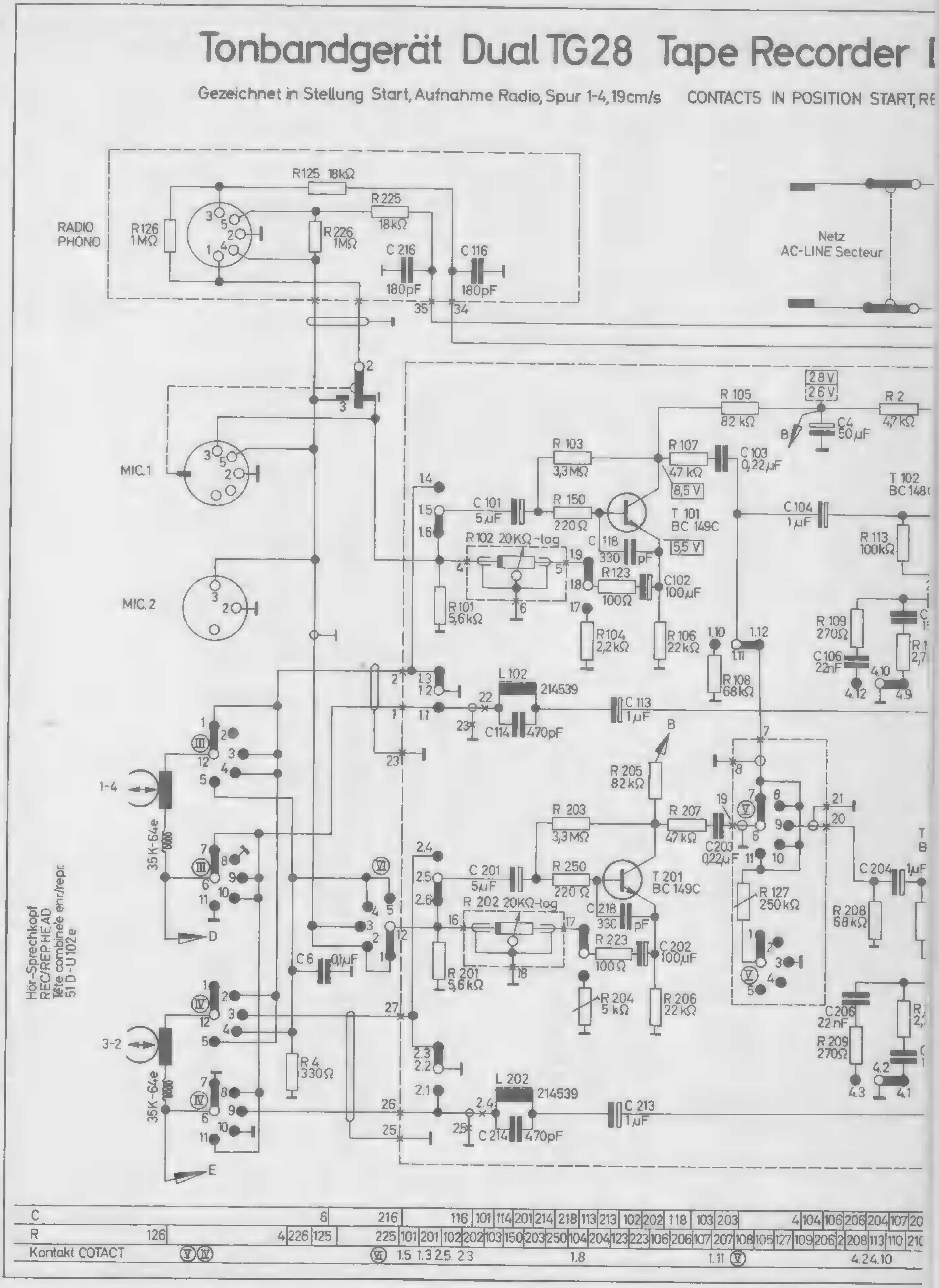
Pos. no.	Part no.	Description	Parts per set	
331	214 515	frame for VU meter ass'y	1	
332	202 243	sheet-metal machine screw BZ 3.5 x 6.5	36	
333	214 533	screening shield	1	
334	217 569	VU meter	1	
335	210 384	flat head screw AM 2.6 x 8	3	
336	214 438	motor pulley, small (50 Hz)	1	
	214 444	motor pulley, small (60 Hz)	1	
337	214 427	motor pulley, large (50 Hz)	1	
	214 432	motor pulley, large (60 Hz)	1	
338	214 384	friction wheel ass'y	1	
339	214 383	compression spring	1	
340	214 381	drive pulley, semi-f.	1	
341	210 222	threaded pin G 2.6 x 5	1	
342	214 387	felt washer	1	
342	211 683	washer	1	
343	217 623	glass cloth foil	1	
344	214 595	drive pulley ass'y (50 Hz)	1	
	214 596	drive pulley ass'y (60 Hz)	1	
345	205 602	fan	1	
346	214 372	motor field coil ass'y	1	
347	214 373	motor field coil ass'y	1	
348	205 456	swing bolt ass'y	1	
349	210 732	silicone tube	1	
350	217 396	stator ass'y	1	
351	210 367	hex nut M 4 x 7	2	
352	210 157	toothed washer A 4.3	3	
353	205 950	connection strip	1	
354	210 099	plastic clamp	2	
*	206 148	tape reel	1	
*	216 603	base CK 10 ass'y	1	
*	203 211	protective cover CH 5 ass'y	1	
*	203 160	facing for base CK 10	1	
*	214 576	packing box for CTG 28	1	
*	214 461	packing box for TG 28 CV	1	
*	214 478	operating instructions	1	
		Resistors		
R 1	216 676	resistance 390 ohms ⅓ W 10 %	1	
R 2	216 677	resistance 4.7 kilohms ¼ W 10 %	1	
R 4	216 675	resistance 330 ohms ¼ W 10 %	1	
R 6	216 698	resistance 10 kilohms ¼ W 10 %	5	
R 8	216 700	resistance 680 ohms ¼ W 10 %	1	
R 9	216 701	resistance 10 ohms ¼ W 10 %	1	
R 30	216 702	resistance 39 ohms ⅓ W 10 %	1	
R 31	216 699	resistance 47 ohms ¼ W 10 %	1	
R 101	216 678	resistance 5.6 kilohms ¼ W 10 %	2	
R 103	216 679	resistance 3.3 mohms ⅓ W 10 %	2	
R 104	216 680	resistance 2.2 kilohms ¼ W 10 %	1	
R 105	216 643	resistance 82 kilohms ¼ W 10 %	2	
R 106	216 644	resistance 22 kilohms ¼ W 10 %	2	
R 107	216 681	resistance 47 kilohms ¼ W 10 %	2	
R 108	216 682	resistance 68 kilohms ¼ W 10 %	2	
R 109	216 683	resistance 270 ohms ¼ W 10 %	2	
R 110	216 696	resistance 2.7 kilohms ¼ W 10 %	4	
R 111	216 675	resistance 330 ohms ¼ W 10 %	2	
R 112	216 643	resistance 82 kilohms ¼ W 10 %	2	
R 113	216 685	resistance 100 kilohms ¼ W 10 %	4	
R 114	209 636	adjustment control 10 kilohms lin.	2	
R 115	216 695	resistance 120 ohms ¼ W 10 %	2	
R 116	216 696	resistance 2.7 kilohms ¼ W 10 %	2	
R 117	216 698	resistance 10 kilohms ¼ W 10 %	5	
R 118	216 698	resistance 10 kilohms ¼ W 10 %	5	
R 119	216 693	resistance 150 kilohms ¼ W 10 %	2	
R 120	216 688	resistance 27 kilohms ¼ W 10 %	2	
R 121	216 685	resistance 100 kilohms ¼ W 10 %	4	
R 122	216 694	resistance 12 kilohms ¼ W 10 %	2	
R 123	216 704	resistance 100 ohms ¼ W 10 %	2	
R 124	216 694	resistance 12 kilohms ¼ W 10 %	2	
R 125	216 416	resistance 18 kilohms ¼ W 10 %	2	
R 126	216 415	resistance 1 mohm ¼ W 10 %	2	
R 128	216 697	resistance 3.3 kilohms ¼ W 10 %	2	
R 150	216 703	resistance 220 ohms ¼ W 10 %	2	
R 201	216 678	resistance 5.6 kilohms ¼ W 10 %	2	
R 203	216 679	resistance 3.3 mohms ⅓ W 10 %	2	
R 204	213 189	adjustment control 5 kilohms lin.	1	
R 205	216 643	resistance 82 kilohms ¼ W 10 %	2	
R 206	216 644	resistance 22 kilohms ¼ W 10 %	2	
R 207	216 681	resistance 47 kilohms ¼ W 10 %	2	
R 208	216 682	resistance 68 kilohms ¼ W 10 %	2	
R 209	216 683	resistance 270 kilohms ¼ W 10 %	2	
R 210	216 696	resistance 2.7 kilohms ¼ W 10 %	4	

* Part is not shown.

Pos. no.	Part no.	Description	Parts per set	
R 211	216 675	resistance 330 ohms ¼ W 10 %	2	
R 212	216 643	resistance 82 kilohms ¼ W 10 %	2	
R 213	216 685	resistance 100 kilohms ¼ W 10 %	4	
R 214	209 636	adjustment control 10 kilohms lin.	2	
R 215	216 695	resistance 120 kilohms ¼ W 10 %	2	
R 216	216 696	resistance 2.7 kilohms ¼ W 10 %	2	
R 217	216 698	resistance 10 kilohms ¼ W 10 %	5	
R 218	216 698	resistance 10 kilohms ¼ W 10 %	5	
R 219	216 693	resistance 150 kilohms ¼ W 10 %	2	
R 220	216 688	resistance 27 kilohms ¼ W 10 %	2	
R 221	216 685	resistance 100 kilohms ¼ W 10 %	4	
R 222	216 694	resistance 12 kilohms ¼ W 10 %	2	
R 223	216 704	resistance 100 ohms ¼ W 10 %	2	
R 224	216 694	resistance 12 kilohms ¼ W 10 %	2	
R 225	216 416	resistance 18 kilohms ¼ W 10 %	2	
R 226	216 415	resistance 1 mohm ¼ W 10 %	2	
R 228	216 697	resistance 3.3 kilohms ¼ W 10 %	2	
R 250	216 703	resistance 220 ohms ¼ W 10 %	2	
		Condensers		
C 1	216 651	electrolytic condenser 2500 μF 20 V	1	
C 2	216 652	electrolytic condenser 500 μF 20 V	1	
C 3	216 653	electrolytic condenser 1000 μF 30 V	1	
C 4	216 657	electrolytic condenser 50 μF 30 V	1	
C 5	216 672	condenser 1 nF 400 V 10 %	1	
C 6	216 648	condenser 0.1 μF 100 V 10 %	1	
C 17	216 668	condenser 10 nF 100 V 5 %	3	
C 101	216 663	tantal-electrolytic condenser 5 μF 25 V	4	
C 102	216 655	electrolytic condenser 100 μF 6 V	2	
C 103	216 659	condenser 0.22 μF 100 V 20 %	2	
C 104	216 664	tantal-electrolytic condenser 1 μF 35 V	4	
C 105	216 667	condenser 100 pF 100 V 10 %	2	
C 106	216 660	condenser 22 nF 100 V 10 %	2	
C 107	216 665	condenser 15 nF 100 V 10 %	2	
C 108	216 668	condenser 10 nF 100 V 5 %	3	
C 109	216 670	condenser 2.2 nF 100 V 10 %	2	
C 110	216 671	condenser 0.1 μF 100 V 20 %	2	
C 111	216 656	electrolytic condenser 250 μF 3 V	2	
C 112	216 663	tantal-electrolytic condenser 5 μF 25 V	4	
C 113	216 664	tantal-electrolytic condenser 1 μF 35 V	4	
C 114	216 658	condenser 470 pF 160 V 10 %	2	
C 116	216 417	condenser 180 pF 100 V 10 %	2	
C 117	216 673	condenser 3.3 nF 100 V 20 %	2	
C 201	216 663	tantal-electrolytic condenser 5 μF 25 V	4	
C 202	216 655	electrolytic condenser 100 μF 6 V	2	
C 203	216 659	condenser 0.22 μF 100 V 20 %	2	
C 204	216 664	tantal-electrolytic condenser 1 μF 35 V	4	
C 205	216 667	condenser 100 pF 100 V 10 %	2	
C 206	216 660	condenser 22 nF 100 V 10 %	2	
C 207	216 665	condenser 15 nF 100 V 10 %	2	
C 208	216 668	condenser 10 nF 100 V 5 %	3	
C 209	216 670	condenser 2.2 nF 100 V 10 %	2	
C 210	216 671	condenser 0.1 μF 100 V 20 %	2	
C 211	216 656	electrolytic condenser 250 μF 3 V	2	
C 212	216 663	tantal-electrolytic condenser 5 μF 25 V	4	
C 213	216 664	tantal-electrolytic condenser 1 μF 35 V	4	
C 214	216 658	condenser 470 pF 160 V 10 %	2	
C 216	216 417	condenser 180 pF 100 V 10 %	2	
C 217	216 673	condenser 3.3 nF 100 V 20 %	2	
		Transistors, Diodes and Coils		
T 4	209 851	transistor BC 107 B	1	
T 101	209 861	transistor B 149 C	2	
T 102	209 858	transistor B 148 C	4	
T 103	209 858	transistor B 148 C	4	
T 201	209 861	transistor B 149 C	2	
T 202	209 858	transistor B 148 C	4	
T 203	209 858	transistor B 148 C	4	
	205 004	cooling bell for transistor casing	1	
G 1	213 296	Si-diode	2	
G 2	213 296	Si-diode	2	
G 103	213 297	Ge-gold wire diode	4	
G 104	213 297	Ge-gold wire diode	4	
G 203	213 297	Ge-gold wire diode	4	
G 204	213 297	Ge-gold wire diode	4	
L 3	214 540	coil	1	
L 101	214 539	coil	4	
L 102	214 539	coil	4	
L 201	214 539	coil	4	
L 202	214 539	coil	4	
	214 538	oscillator coil	1	

Right to changes reserved.

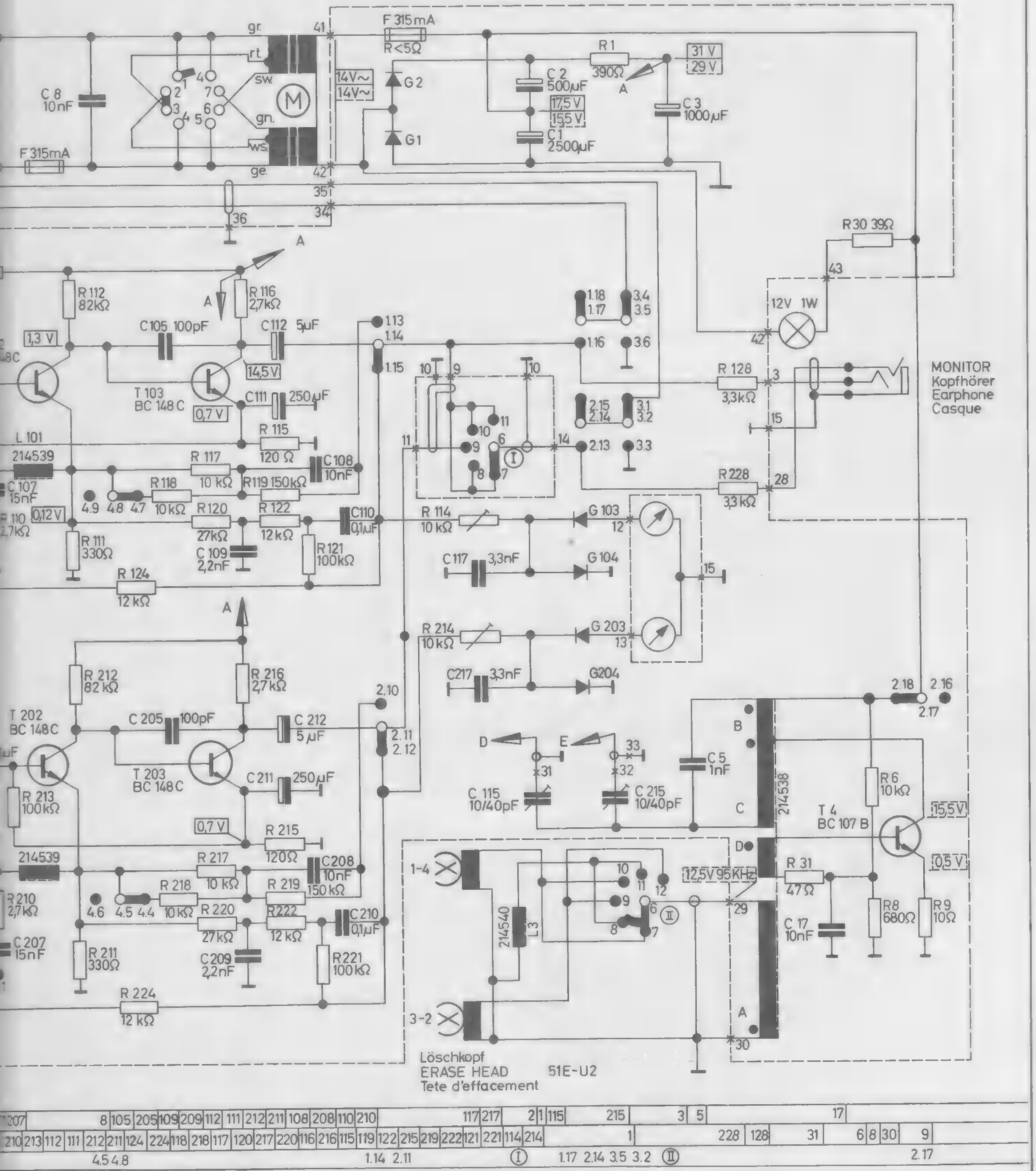
Fig. 16 Wiring diagram Dual TG 28



R 102 / R 202 Autnahmepegel; R 204 Wiedergabe-Symetrie; R 114 / 214 Aussteuerungsinstrumenteinstellung; C 115 / 215 Vormagne

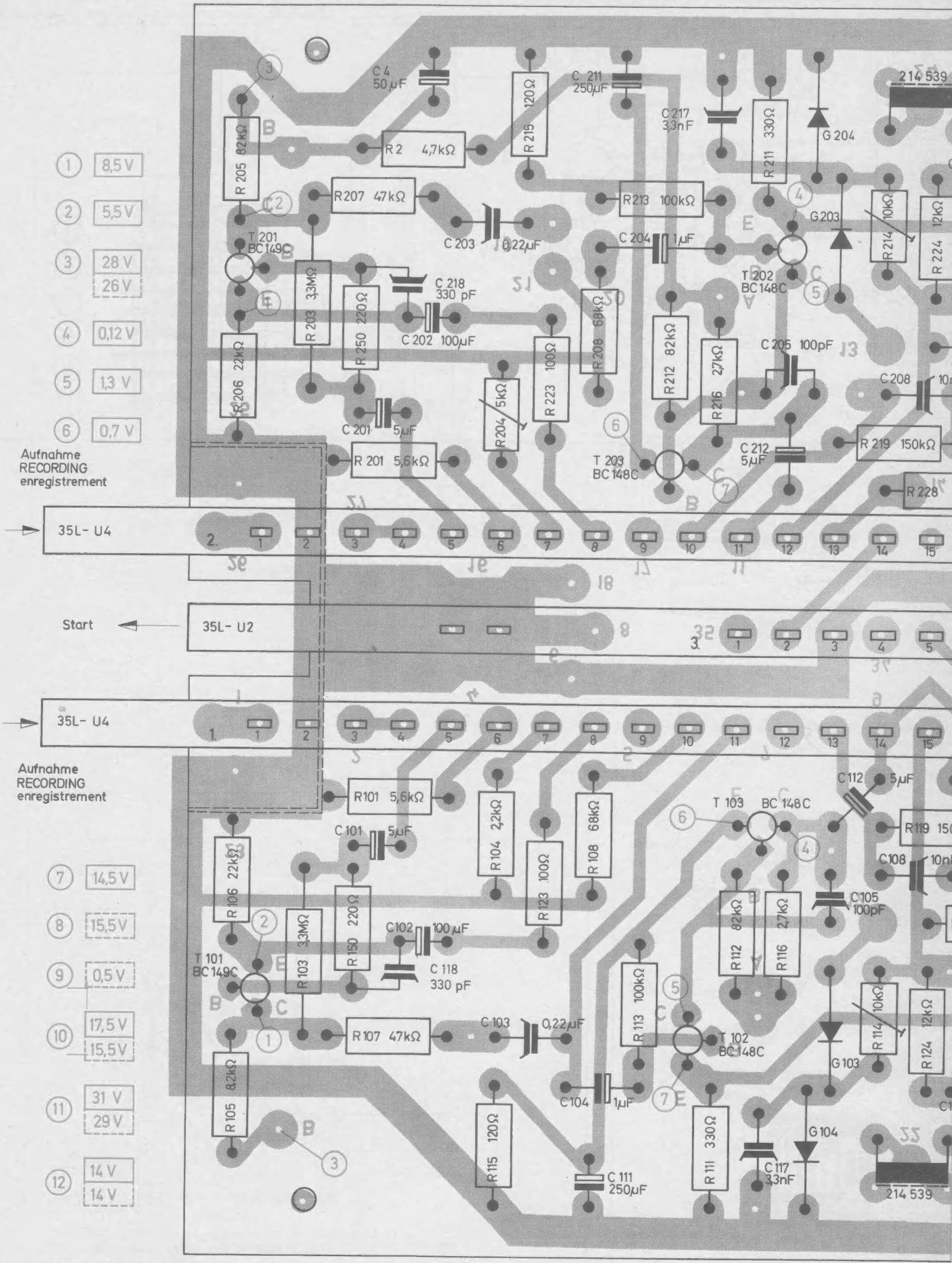
Dual TG28 Enregistreur sur bande Dual TG28

RECORDING RADIO, TRACK 1-4,19cm/s Contacts en position start, enregistrement radio, piste 1-4, 19cm/s



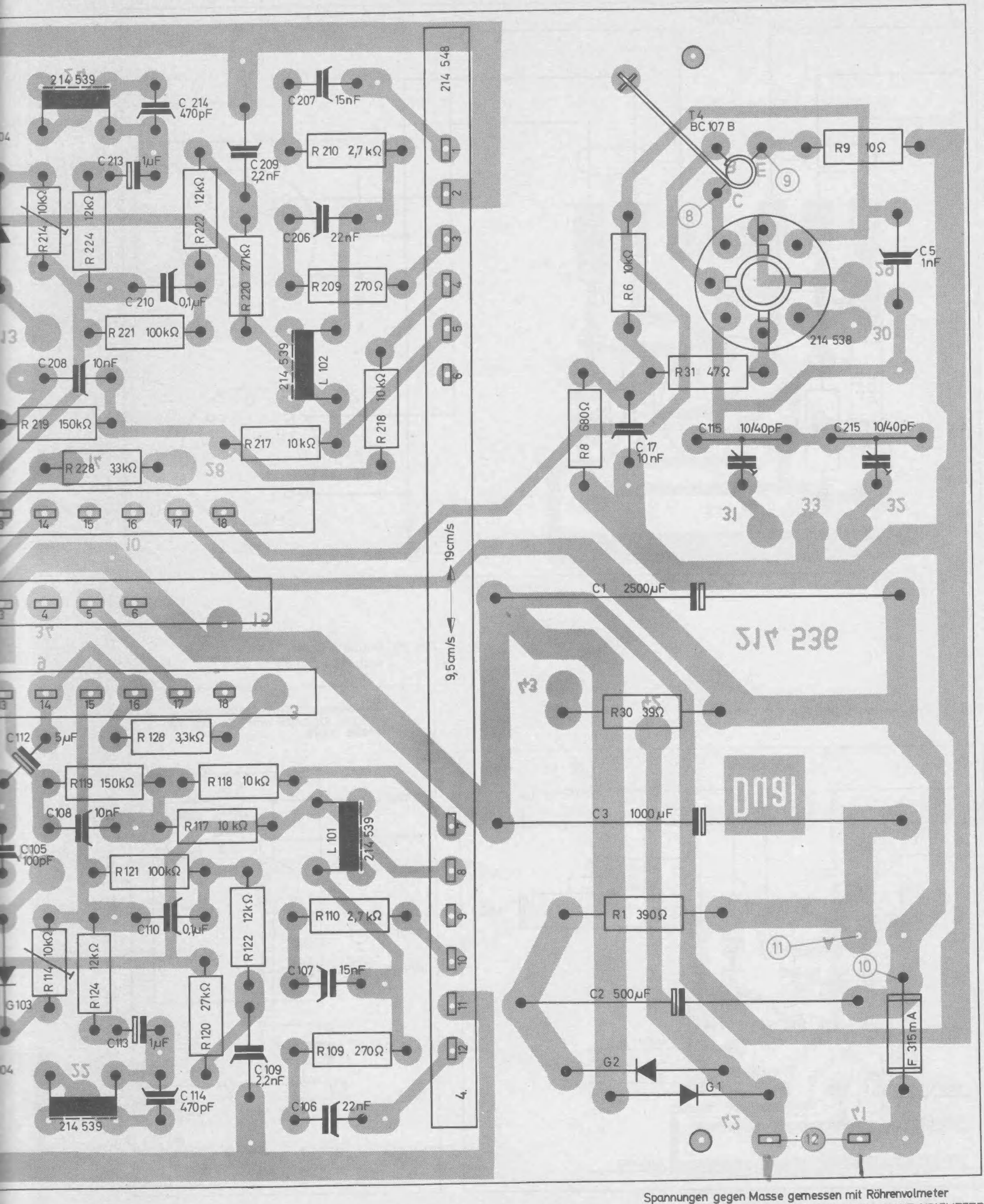
Änderungen vorbehalten

Fig. 17 P.C. Board, components and voltage readings Dual TG 28



☐ Wiedergabe IN PLAYBACK POS. Reproduction

┆ Aufnahme IN RECORD. POS. Enregistrement



Spannungen gegen Masse gemessen mit Röhrenvoltmeter
VOLTAGES MEASURED TO CHASSIS WITH VALVE VOLTMETER
Tensions relevées avec voltmètre à lampe

Fig. 18 P.C. Board with phone jack

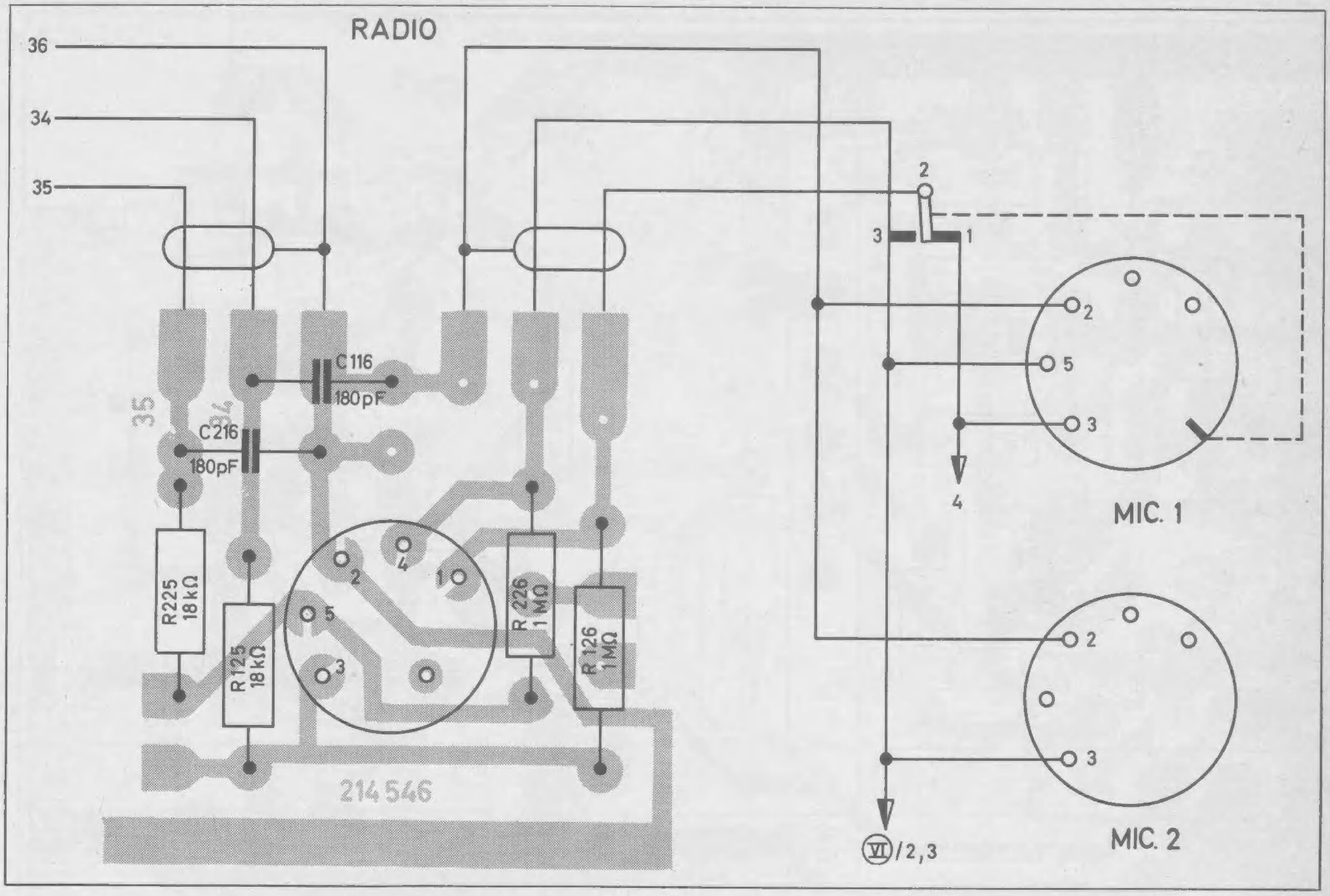


Fig. 19 P.C. Board with RCA and phone jacks

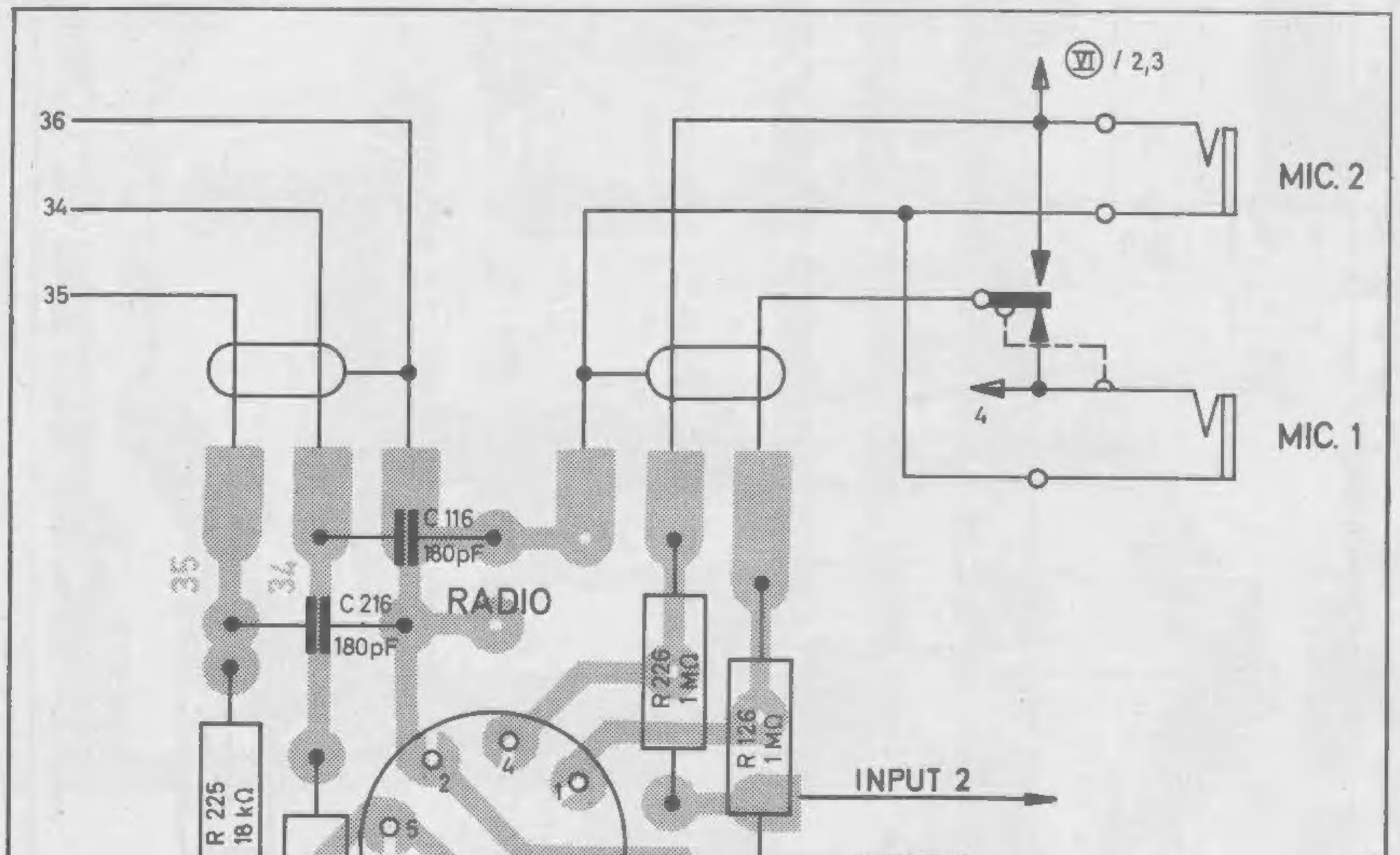


Fig. 20 Wiring diagram
with RCA and phone jacks

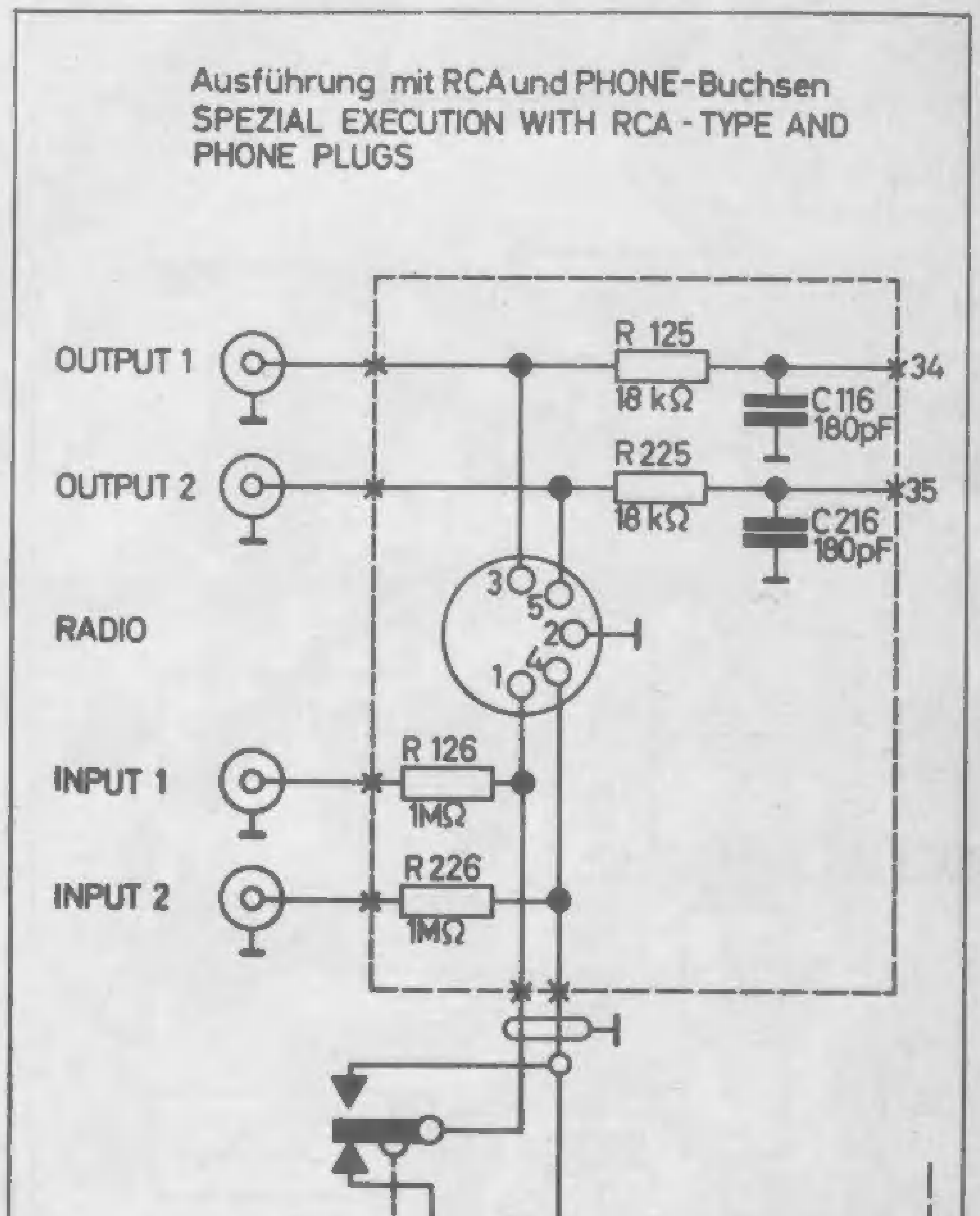


Fig. 21 Track switch (top view)

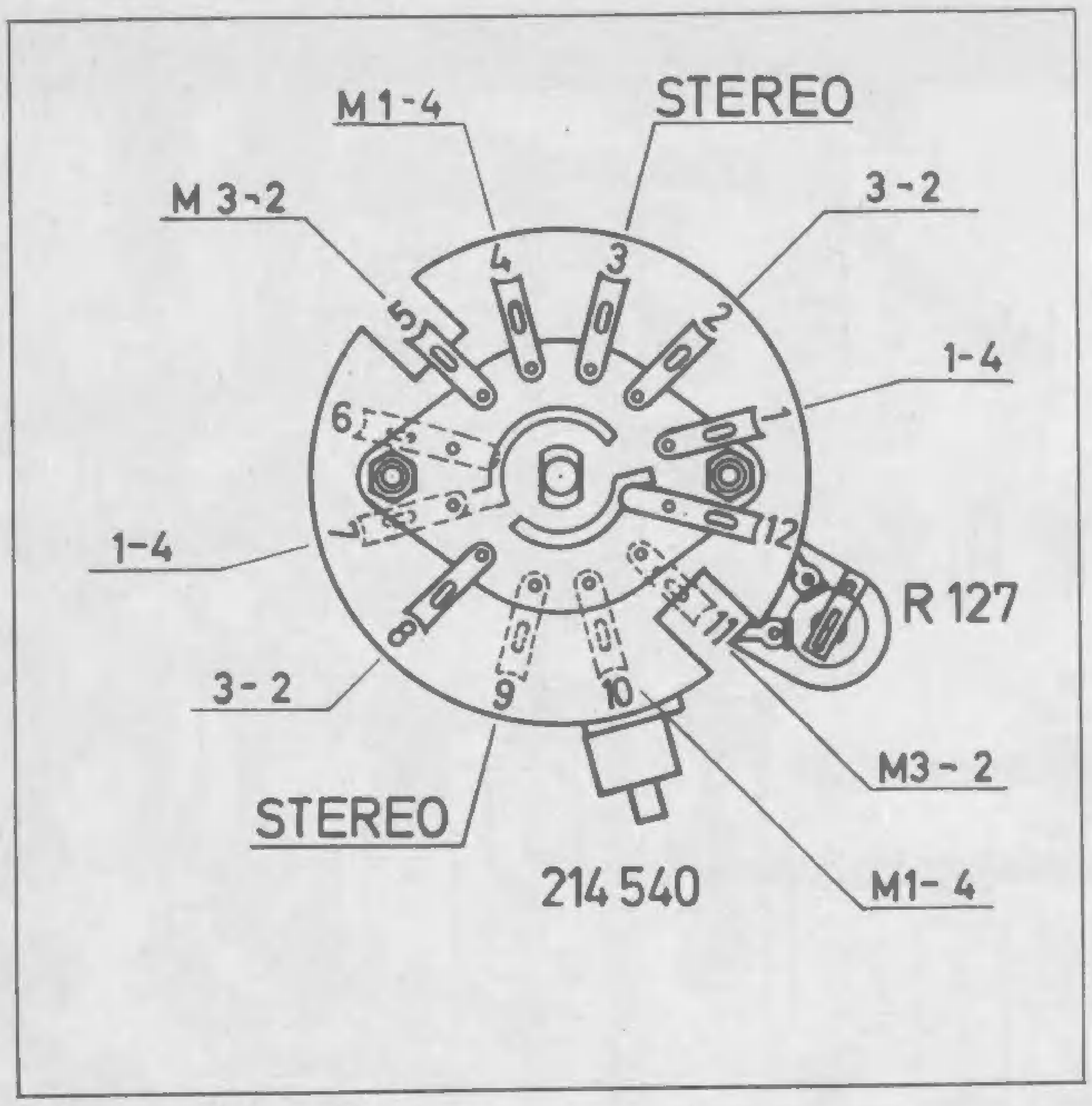
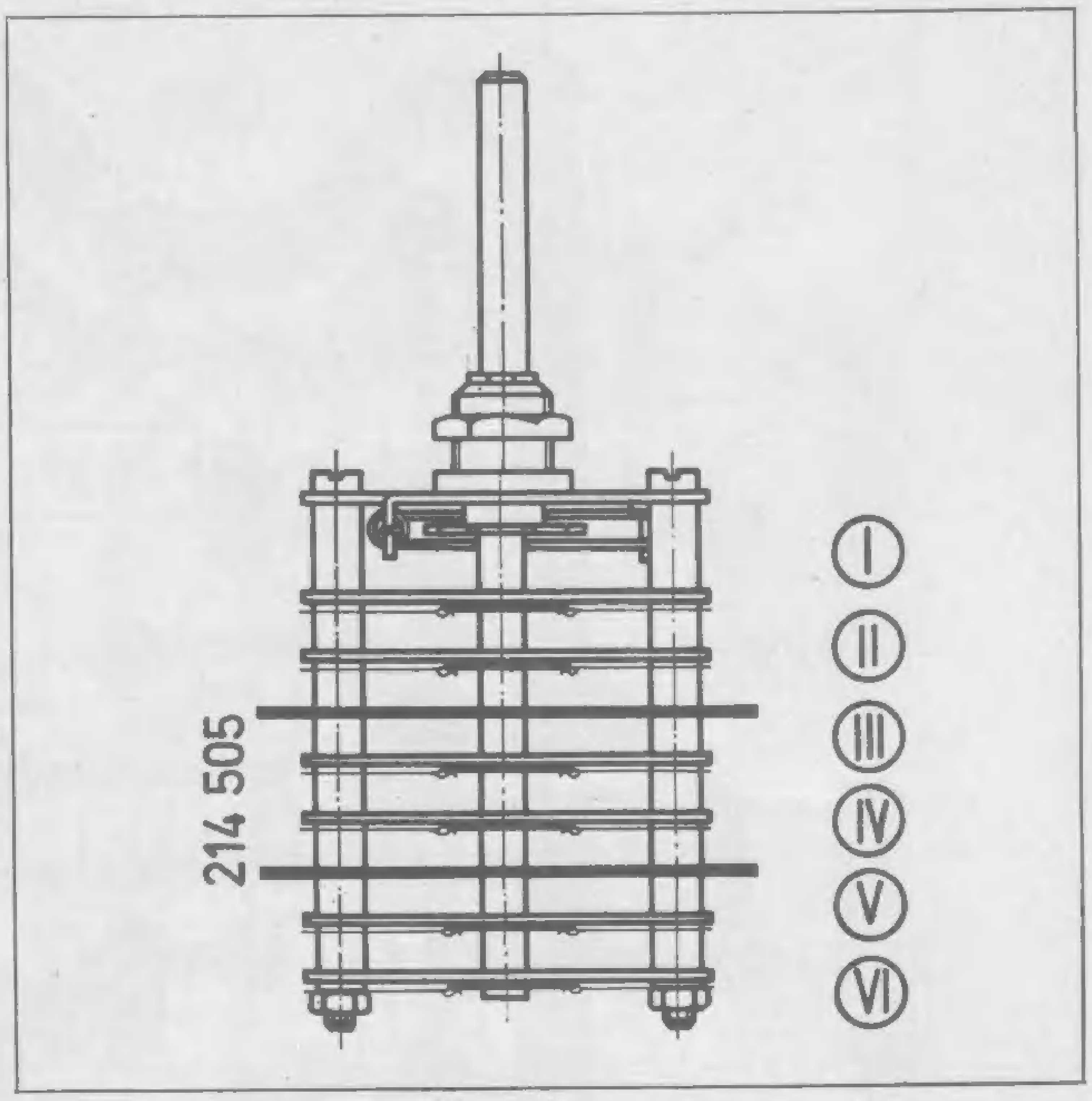


Fig. 22 Track switch (side view)



Dual

Dual Gebrüder Steidinger · 7742 St. Georgen/Schwarzwald